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THE INSTITUTION OF PRODUCTION ENGINEERS

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SCHOFIELD TRAVEL SCHOLARSHIPS, 1953

THE Institution is pleased to announce that applications are now invited for the 1953 Schofield Travel Scholarships.

It is intended to offer two Scholarships for 1953, which will entitle the successful Graduates to visit selected European countries for industrial study visits of six months duration. Each Scholar will have an opportunity of carrying out his project in one or more firms.

Objects of the Scholarship Scheme

(i) To provide facilities whereby young Production Engineers are given an opportunity of broadening their outlook, and of improving their knowledge of production functions, both technical and managerial.

(ii) To improve productivity in this country by the implementation and dissemination of such knowledge.

(iii) To stimulate interest in production by offering these facilities.

(iv) To help foster a better understanding of the modes of life, social conditions and, in particular, of the production methods employed in the industries of European countries and in such other countries as may from time to time appear desirable.

Conditions for the 1953 Scholarship

(i) Two Scholarships will be offered, covering a period of six months. Council reserve the right to make no award if the entries are not considered to be of sufficiently high standard.

(ii) Graduates entering for the Scholarships must have attained their 23rd birthday, but not have passed their 30th birthday, on 1st January, 1953. No Graduate who was elected after 1st January, 1952, will be accepted as a candidate.

(iii) Application forms may be obtained from the Head Office of the Institution, and should be completed and returned by candidates not later than Monday, 13th October, 1952.

(iv) Successful candidates will be required to devote the whole of their time abroad to the project which they have selected. On their return they will be required to read a paper in their Sections, and to report on their projects in any other way which may be considered desirable by the Institution.

(v) Graduates entering for the award this year who are unsuccessful, may enter for future awards, subject to the particular conditions then in force.

Selection Procedure

(i) Preliminary selection will be carried out by Section Committees.

(ii) Candidates who are successful at this preliminary stage will proceed to the next stage, which involves the preparation of a paper on the project which they propose to carry out if awarded a Scholarship.

Such papers should include a detailed background of the candidates' knowledge and experience, which they consider will enable them to make a profitable investigation of their selected subjects.

The projects should have a direct bearing on production, and in particular on that aspect of it with which the candidate is concerned at the time of entering for the award.

When submitting their papers, candidates will be required to furnish a statement from their employers certifying that in the event of being selected for a Scholarship, they will be granted the necessary leave of absence.

(iii) After assessment of the papers submitted, certain candidates will be selected to attend a final group interview.

It is important to note that at all stages of the selection procedure the personal qualities of candidates will be given equal consideration with their academic and industrial attainments.

WORK STUDY — APPLICATION AND TRAINING

Third Report of the Joint Committee on Measurement of Productivity

STUDENTS and members will have already received, with the August issue of the Journal, an advance notice concerning the latest Report, "Work Study—Application and Training,"[1] prepared by the Joint Committee of the Institute of Cost and Works Accountants and the Institution of Production Engineers.

This Report, which reviews the application of work study in industry and puts forward detailed recommendations for a syllabus of training, makes extensive proposals for the selection and training of work study staff in industry as a means of achieving greater efficiency in methods and operations, and more accurate time study techniques for measuring and improving productivity.

Formation of Joint Committee

The Joint Committee was set up in 1949 to examine means of measuring and increasing productivity. Its earlier comments on time study methods in industry, contained in an Interim Report[2] published in December of that year, gave rise to the investigations on which the present Report is based. The sub-committee responsible for this Report included representatives of the Institution of Production Engineers, the Institute of Economic Engineering, the Institute of Industrial Technicians, together with work study superintendents, an industrial consultant and a teacher of the subject from a Technical College. During the investigations, moreover, contact was made with a representative cross-section of people, colleges, institutes and industries concerned with work study training both in the United Kingdom and overseas.

To achieve a comprehensive examination the sub-committee investigated industry's requirements for the measurement of productivity, the scope and purpose of work study, time study procedures, the qualifications and selection of time study personnel and existing training schemes and facilities, before evolving its recommended training procedure. During the course of these enquiries it was found that the time study function represented only part of the subject with which the sub-committee was concerned whereas work study, which embraces methods study, motion study, time study and job evaluation, covered all the activities that came within its purview.

[1] Available October 1952 price 5/- from the sole distributors, Gee & Co., Publishers, Ltd., 27/28, Basinghall Street, London, E.C.4.

[2] Interim Report on Measurement of Productivity. Price 1/6d. from the sole distributors, McDonald & Evans, 8, John Street, Bedford Row, London, W.C.1.

The Report points out that for a number of years many industrial firms have used a financial record like standard costs, budgetary control, periodical accounts, to record the effectiveness of operations. Economists, too, have used statistics to assess relative efficiencies in industry, to forecast trends and to set annual targets. What is also needed, however, is a way of measuring the effectiveness of each industrial function and of setting targets of achievement that is intelligible to factory managers, foremen, shop-stewards, craftsmen and operators alike.

Use of Time as a Unit

There are many reasons why time is the most suitable unit for this kind of measurement. Time study standards have many uses, such as in machine loading, costing, labour loading and in determining the most effective methods, while when used for comparing productivity the standard is based on what can be achieved rather than on what has been achieved.

But investigations in a number of manufacturing companies revealed serious discrepancies in the application of time study methods which make these standards unsuitable for comparing the effectiveness of departments or firms. Greater uniformity in the methods of arriving at time study standards would, therefore, make valuable data available and the report strongly emphasises the need for more accurate time study techniques.

Where time study is used as a basis for payment by results, it has been found to be most effective in those instances where work study procedure is applied in full. For only by first ensuring that the job is done in the best possible way and to the required quality and then setting an accurate standard time for it, can a sound basis for this type of incentive payment be arrived at.

Improved Training

The Report recognises that time study has often been a source of friction in industry and expresses the opinion that much distrust could be overcome by improving the training of work study staff and through a better understanding of the subject by management, supervisors, technicians and work people. Some interesting examples of the results obtained from the application of work study by trained personnel are given, but the sub-committee does not suggest that better training alone will yield the best results. In the main the attitude of top management is the deciding factor.

> "The atmosphere in the undertaking must be a positive one, always looking for more effective ways. The organisation must be built up so that each person's responsibility in relation to work study is clearly understood. There must be adequate co-ordination and consultation with all concerned before an improvement is introduced, or a time value applied.

" If these things do not exist, work study may result only in savings on paper and not on production. In order, therefore, that the full benefits of training in this field can be achieved, whole-hearted support must be forthcoming from top management, and from it right through the organisation."

Varying Definitions

One of the difficulties which the sub-committee ran up against was the wide range of activites covered in different undertakings by such terms as time study, work study, industrial engineering, and so on. So, to help in the preparation of a training syllabus and as a guide to the selection of suitable staff, the Report gives a detailed analysis of the requirements of the job and the personal characteristics needed by people responsible for work study. An example of the sort of experience and background considered desirable is also given.

A number of important factors affecting the training of work study staff is discussed, chief among them being the human factor.

" The work study student must understand that he will be expected to find not only better methods, but also better ways of persuading people to accept his aims and his results. Many technicians have been frustrated because their technical knowledge has outstripped their ability to get their ideas accepted."

Because of the different systems of work measurement in use, which are discussed in the Report, it is suggested that work study trainees, besides being given detailed tuition in the particular systems to be employed, should be given a general appreciation of all current methods.

The syllabus which the sub-committee recommends is fully set out in the report. It is suggested that if it is to be attended full-time the course should last three months, but if part-time it should be spread over two years. A substantial proportion of this time should be devoted to properly controlled and supervised work study practice under operating conditions. It is recognised, however, that ever-changing trends in industrial techniques and systems, which the Report surveys, demand that the training syllabus be kept under constant review. " The vital need for maintaining a dynamic syllabus that can grow and develop to meet changing needs " is emphasised.

Attention is given to the problems of recruiting and selecting qualified teachers in work study. On one important aspect of this part of its findings the sub-committee is outspoken. It observes that " work study teachers are frequently offered lower salaries than work study practitioners."

Importance to British Industry

The Report concludes that improved work study training is vital in British Industry for two main reasons. First, so that effective method and motion study may be used to develop more economical production methods. Second, so that more accurate time study may be used to measure output and the knowledge thus obtained applied to raising productivity. Practical recommendations to give effect to the policy proposed are put forward. Some of the recommendations concern the introduction of additional courses, maintaining the standard of quality of courses and of examination standards, and the need for professional institutions and educational authorities to recognise these courses.

Other recommendations refer to the selection and training of teachers in work study, and the assistance which firms can give to local technical colleges by aiding part-time tutors on their staffs and by providing facilities for practical training. One particularly unsatisfactory feature connected with the subject of work study today could, the Report suggests, be rectified if an authoritative committee were to be established to draw up and maintain up-to-date a work study nomenclature.

The conclusion of the Report also reiterates the responsibility of management for the effective use of work study and a series of questions are posed in an appendix, the answers to which should shown the industrial manager to what extent his work study staff would benefit from further training.

This Report goes a long way towards solving some of the problems brought to light in the Joint Committee's Interim Report of 1949. As a result of its comprehensive examination, substantial advances in the direction of obtaining more reliable facts about industrial operations and of devising more effective ways of raising output should now be possible. Not only managers, but also Production Engineers, Cost Accountants and students of industry should find it invaluable.

INSTITUTION NOTES

September, 1952

Education Discussion Group

At the recent Meeting, reported on pages 401-405, Council were pleased to approve the formation within the Institution of an Education Discussion Group. It is hoped that the establishment of this specialist Group will stimulate thought, discussion, and eventually the publication of useful literature on the teaching of Production Engineering subjects.

Members engaged as full-time or part-time teachers would be suitable for membership of this Group, but others interested in the educational aspects of Production Engineering may also wish to join.

It is proposed in the first instance that centres shall be formed in three areas—London, the Midlands and the North of England. Members in the centres selected will meet regularly to exchange views on the teaching of Production Engineering subjects, but members from other areas will have the opportunity of receiving the findings of these centres and of contributing to them by post.

Any member interested in the Group should notify the Secretary, unless he has already done so.

Further details will be sent shortly to all members who have enrolled in the Group, so that an early start may be made during the 1952/53 session.

Lord Austin Prize, 1951

As will be seen from the Council Report (p. 401), the Lord Austin Prize for 1951, consisting of a miniature shield and books or instruments to the value of £10 10s. has been awarded to Mr. J. Irwin, a Graduate of the London Section, for his essay on 'The Automatic Production of Pressed Glassware.'

Certificates of Merit have been awarded to Mr. R. S. Cracknell, Graduate of the Halifax Section, for his paper on 'Work Study and Work Measurement as an Aid to Factory Re-organisation,' and to Mr. D. Whitehead, Graduate of the Manchester Section, for his paper on 'Plastic Moulding and Mould Tool Design.'

The presentations will be made at the Institution's Annual Dinner next month.

Symposium on Properties of Metallic Surfaces

The Institute of Metals has organised a Symposium on Properties of Metallic Surfaces which will be held in the Lecture Theatre of the Royal Institution of Great Britain, Albemarle Street, London, W.1, on Wednesday, 19th November, 1952.

Members of the Institution of Production Engineers have been cordially invited to participate in this meeting, which it is expected will be attended by many scientists from all parts of the world.

Applications for programmes and registration forms should be forwarded to The Secretary, The Institute of Metals, 4, Grosvenor Gardens, London, S.W.1. It should be noted that the registration fee of five shillings will entitle those attending the meeting to a set of advance copies of the papers.

International Machine Tool Exhibition

Through the generosity of the organisers, the Institution will for the first time have a Stand (No. 265, Empire Hall) at the International Machine Tool Exhibition, which takes place this year at Olympia from 17th September to 4th October.

Head Office staff will be in attendance to deal with any enquiries concerning Institution activities, and members and friends visiting the Stand during the Exhibition will be warmly welcomed.

Work Simplification

Courses on 'Work Simplification in the Office,' organised by the Polytechnic Department of Management Studies and introduced last Session, have been very well attended and it is proposed, therefore, to continue them in the coming Session. The Courses are an attempt to apply the principles of work study to office organisation in order to increase productivity and reduce cost.

Students taking the Courses meet fortnightly for three terms and are encouraged, from the beginning, to apply Work Simplification techniques to their own work. Four new Courses will begin towards the end of this month and full particulars may be obtained from the Registrar, The Department of Management Studies, The Polytechnic, St. Katherine House, 194, Albany Street, London, N.W.1.

Melbourne Section Visit

A most interesting visit to the Ford Company's Works at Geelong was recently organised by the Melbourne Section of the Institution. Members were welcomed by Mr. Andrew Miller, Production Superintendent, and executive staff who, after an excellent luncheon, conducted the visitors over the Company's extensive plant.

In the evening, following a most successful buffet dinner held at the Carlton Hotel, Geelong, Sir John Storey, B.Sc., President of the Australian Sub-Council, addressed a large gathering of members and guests. The occasion concluded with an entertaining talk by Mr. Andrew Miller on " Production Has The Green Light."

Mr. B. G. Ross, President of the Melbourne Section, expressed thanks on behalf of those attending for the Ford Company's hospitality.

NEWS OF MEMBERS

Mr. S. Alexander, Associate Member, has been appointed Works Manager, Production, at the Government Central Workshops, Amritsar, Punjab, India.

Mr. G. F. Baggett, Associate Member, has transferred from the Nigerian Railway Mechanical Department to the Department of Commerce and Industries, Lagos, where he is employed as an Industrial Officer.

Mr. H. W. Bowen, O.B.E., Member, has accepted the appointment of Managing Director of the Britannic Electric Cable & Construction Co. Ltd. Mr. Bowen recently resigned from the position of Managing Director of E.M.I. Factories, Hayes, Middlesex.

Mr. B. H. Dyson, Member, and Mr. E. W. Hancock, M.B.E., Member, have been elected to the Council of the Production Engineering Research Association of Great Britain.

Mr. A. E. C. Gregg, Member, has been appointed Colliery Engineer of No. 3 Colliery, Wankie Colliery Co. Ltd., Wankie, Southern Rhodesia.

Mr. H. Hulme, Associate Member, has taken up the position of Works Manager with the Wexford Engineering Co. Ltd., Wexford.

Mr. P. S. Khokhar, Associate Member, has been transferred to the Refinery Workshops of the Assam Oil Co. Ltd., Digboi, Upper Assam, where he is Engineer-in-Charge, Workshops.

Mr. R. A. Lowe, Associate, is now a partner in the firm of R. A. Lowe & Partners, Machine Tool Consulting & Inspecting Engineers, Reading.

Mr. G. Stowe, Associate Member, has relinquished his appointment as Training Engineer with the Plessey Co. Ltd., and has taken up the position of Production Engineer with J. Mercer & Sons, Ltd., Christchurch, New Zealand.

Mr. L. S. Trew, Associate Member, is now Assistant to the Manager of the Rolls-Royce Factory, East Kilbride.

Mr. H. H. Valberg, Associate Member, has taken the post of Works Manager with The Falkirk Iron Co. Ltd., Falkirk.

Mr. R. C. Wallace, Associate Member, is taking up an appointment as Lecturer at the Kumasi College of Technology, Gold Coast.

Mr. B. T. Aston, Graduate, is now employed as Technical Assistant to the Divisional Manager, Automatic Division, Lockheed Hydraulic Brake Co. Ltd., Leamington Spa.

Mr. R. Prescott, Graduate, is now employed as Mechanical Design Engineer with Standard Telephones & Cables, Ltd.

Mr. Peter Spear, B.Eng., Graduate, has been appointed Director of Research at the Research and Development Department of Rubery, Owen & Co. Ltd., Darlaston.

Mr. E. W. White, Graduate, has been appointed Service Manager at the Hoffmann Manufacturing Co. Ltd., Chelmsford.

Visitor from Abroad

Mr. J. B. Arnold, Member, of the Melbourne Section, is at present in the United Kingdom on a business visit.

A Canadian Appointment

Mr. R. H. Line, Member, until recently General Manager of Frigidaire and a Director of General Motors, Ltd., London, has been appointed President and General Manager of Kelvinator of Canada Ltd., with Headquarters in London, Ontario.

Mr. R. H. Line

Mr. Line joined General Motors in 1945 whilst in the U.S.A., and was appointed Director in charge of operations at their Frigidaire Hendon Plant in 1946. He was subsequently appointed Director and General Manager, and directed post-war development and expansion at the Hendon Plant.

In addition to his membership of the Institution of Production Engineers, Mr. Line is an Associate of the Institution of Electrical Engineers and a Member of the Incorporated Sales Managers' Association.

HAZLETON MEMORIAL LIBRARY

It would be helpful if, in addition to the title, the author's name and the classification number could be quoted when borrowing books.

REVIEWS

658.54 TIME AND MOTION STUDY

"Motion and Time Study: Principles and Practice" by Marvin E. Mundel. *N.Y., Prentice-Hall.* 1950. 457 *pages. Illustrated. Diagrams.* £2 12s.

This book is divided into four main sections:
(*a*) The general introduction to Motion and Time Study; (*b*) Motion Study; (*c*) Time Study; (*d*) Application of Motion and Time Study.

More than half this book is devoted to the first two sections and not until the method has been fully surveyed is consideration given to Time Study.

In the first chapters Motion and Time Study is broadly surveyed with the aid of " before " and " after " examples. These examples vary from assembly and machining operations to office work, general layout and product design. In the second chapter, the all-important human factor is considered and the need to cater for the operator made redundant by the new method realised.

Seven steps are listed for the systematic analysis of any job. These are—aim, analysis, criticism, innovation, test, trial and application, and are applicable irrespective of the type of work performed.

Mundel has introduced five " classes " of change that may be possible when introducing a new work method and has stressed the importance of fully analysing these, using the " possibility guide " before establishing the criteria of the solution. The particular class that the method change falls into will decide the type of analysis to be pursued. These are detailed in the succeeding chapters under the headings of Process Charts (production, man and combined analysis), Operation Charts and Multi-Activity Analysis, Micro and Memo motion study.

In all these chapters the subject matter is illustrated with many worked examples in chart and diagrammatic form over a wide variety of types of operations.

In considering Time Study, the need for measurement is clearly stated for all the many uses for which it is required—eleven are quoted—firstly emphasising the need for clearly stating the method to be used before the measurement is made. Here again examples are given of Time Study write-ups. Time and Rating are fully discussed and particularly the conception known as " objective rating."

The analysis and synthesis of time standards end the first three parts of the book, which is continued with applying Motion and Time Study and a lengthy chapter is given to problems specific to each chapter of the book.

Finally, the volume concludes with a bibliography of 265 books classified by type of industry.

G.R.B.

667.6 PAINTS

" Paint Film Defects, Their Causes and Cure " by Manfred Hess. *London, Chapman & Hall.* 1951. 544 *pages. Illustrated.* £2 10s.

This is a new publication by Chapman & Hall, compiled by Manfred Hess as a translation, with certain revisions and additions, of " Haufige Anstrichmangel and Anstrichschaden, Ihre Ursachen und Verhutung " which was first published as a German edition in 1938.

Bearing in mind the universal application of paint and enamel finishes, this book should meet a popular demand and can be regarded as a text book on the subject, covering practically every problem that is likely to arise. The book is divided into four sections: 1. Faults which develop during storage. 2. Faults developed during application. 3. Failures developing shortly after application. 4. Defects of coatings on the finished objects when in use. Also included in Section (2) are several chapters on damage to health, such as dermatitis, lead poisoning, skin troubles, etc.

With the help of a very comprehensive subject index, it is easy for the reader to find a remedy for any given fault and the explanations are written in a manner which is seldom academic and therefore can be readily understood by the Foreman in the Shop.

From the wealth of information, one can pick out headings covering adhesion requirements, corrosion and resistance to acids, nitro-cellulose lacquers, problems of blistering and over-baking, priming coats, stoving temperatures, storage conditions, etc.

This book can be recommended as a necessity in any Works Library, also as a standard reference book for the chemist and practical man alike.

H.L.M.

331.152 CO-OPERATIVE ADMINISTRATION: JOINT CONSULTATION

"Co-operation in Industry, Workers, Employers, Public Authorities" *Geneva, International Labour Office.* 1951. 238 *pages.* 9/-. (*Studies and Reports; N.S. No.* 26.)

This publication by the International Labour Office deals with the question of co-operation in industry in a broad but comprehensive manner. The first section surveys the progress made in co-operation at the level of the undertaking, and compares various types of Joint Consultative machinery used in different countries.

The second section goes a step further to the level of industry itself, and notes that in this sphere, the greatest efforts to set up efficient machinery for co-operation have been made in those countries which have been called upon to exert all their energies in restoring their national economies since the War.

The final section brings us to the national level and to questions of co-operation between Governments and employers and workers' organisations. As in the other sections, co-operative machinery set up on a voluntary basis, and that introduced by some form of legislation or Government initiative, are discussed separately. The publication gives a good picture of what has been and is being achieved in this field in many different countries. On reading it, one is made aware of a growing realisation of the importance of the human factor in any effort to increase production.

R.H.

658.562 INSPECTION: QUALITY CONTROL

"Quality Control Handbook" edited and partly written by J. M. Juran. *N.Y., McGraw-Hill. 1951.* 800 *pages. Diagrams.* £4 5s. (*Industrial Organisation and Management Series.*)

This volume comprises fifteen sections, each the work of an expert, covering the various branches of Quality Control.

The first eight sections treat in great detail the theory and practice of the whole subject, and define, to quote the preface, "Those principles which are universal, no matter what the product or process." Details are given of many different types of control plans, and, a very important point, methods are suggested of introducing Quality Control into going plants. There is a very comprehensive section covering the purely theoretical side of the subject, and the more commonly used statistical tables are included, together with many sampling tables.

The remaining seven sections of the book deal with the application of Quality Control principles to particular products or processes, and here we might note that the editor intends, in subsequent editions, greatly to expand the number of such sections. Various applications are described, from textile production and chemical processing to aircraft manufacture and screw machine production. A further section describes the use of electrical accounting machines in Quality Control.

The vast amount of research and practical work on the subject which has been carried out in America in recent years is evident from the size and scope of this book, which will be to the Quality Control engineer what the normal engineering handbook is to the mechanical or electrical engineer.

G.J.P.

ABSTRACTS

658.575 DESIGN

"Production Processes, Their Influence on Design, Vol. II" by Roger W. Bolz. *Cleveland, Penton Pub. Co.* 1951. 356 *pages. Illustrated.* £3. (*Machine Design Series.*)

This book, taken in conjunction with Vol. I, gives descriptions of the major manufacturing methods. The section on casting describes sand casting, centrifugal casting and die casting, both pressure and gravity.

The second section describes moulding methods for plastics, rubber and ceramics, also powder metallurgy.

The section on fabricating describes a full range of welding methods and also a chapter on brazing and the final section briefly considers heat treatment and shot blasting.

There are many diagrams showing ideal conditions and common faults of design, also several tables giving typical figures for alloy strengths, machine allowances, and typical tolerances.

The book has nearly 350 illustrations in line and half tone. Care should be taken in the interpretation of the American technical terms, e.g. " permanent mold casting " and " die casting " should be read as " gravity " and " pressure die casting " respectively.

621.89 LUBRICATION

" Metalworking Lubricants, Their Selection, Application and Maintenance " by E. L. H. Bastian. *N.Y., McGraw-Hill.* 1951. 357 *pages. Illustrated. Diagrams.* £2 8s.

The author, staff engineer of the American Shell Oil Company and an extensive contributor to the technical and trade press of the metal industry, deals in 10 out of the 15 chapters of this book with the various lubricants used in the actual processes of metal forming and shaping. Of the remainder three are devoted to the lubrication of the machine tools and other equipment and the last two give a survey of lubricant test procedure. Tables of the properties of copper and aluminium alloys, analytical methods, etc., are contained in eight appendices.

Each section is annotated with references, mainly from American technical papers and Company publications.

The author, after giving a general survey of the types of fluids and compounds used, describes the processes used in America for Cutting, Drawing, Extrusion Moulding, Forging, Rolling, Quenching and Metal Coating of ferrous and non-ferrous alloys. Contained in each section are the functions, desiderata and general characteristics of the lubricants used.

669.14 STEEL

" Steels in Modern Industry " edited by W. E. Benbow. *London, Iliffe & Sons Ltd.*, for *Iron and Steel.* 1951. 562 *pages. Illustrated. Diagrams.* 42/–

Many industrial specialists have contributed to this book which opens with a brief metallurgical review followed by articles on wear, mechanical properties, fatigue, creep, corrosion, scaling resistance, weldability and machinability. Part Three deals with specific uses such as structural, aircraft and automobile, gas and steam turbines, boilers and piping, pressure vessels, steels for the chemical industries, tools and dies, cold pressing and electrical steels. The book closes with surface treatments, shot peening and hardening methods such as nitriding, carburizing and flame and induction methods.

669.2 NON-FERROUS METALS

" Hot Working of Non-Ferrous Metals and Alloys: A Symposium on Metallurgical Aspects of the Subject." *London, The Institute.* 1951. 208 *pages. Illustrated. Diagrams.* 15/–. (*Institute of Metals Monograph and Report Series No.* 9.)

This book records the papers and discussions given at a symposium on metallurgical aspects of the subject.

The first three of the papers deal, respectively, with the hot rolling, the extrusion, and the hot forging and hot stamping of aluminium and its alloys.

The next four papers cover the hot working of magnesium and its alloys, copper and its alloys, tin bronzes, and lead and lead-rich alloys. The last paper is concerned with the rolling of zinc and zinc-rich alloys.

The authors of all papers are experts in their fields and have been drawn from the ranks of practising metallurgists. The result is a volume free from mathematics and yet concerned not only with practical matters but also with the under-lying theory. The illustrations cover photographs of typical hot worked components, equilibrium diagrams, and micro- and macro-structures of the materials at various stages in the working.

OTHER ADDITIONS

159.9 PSYCHOLOGY

Wyatt, S., and Langdon, J. N. **"Fatigue and Boredom in Repetitive Work."** *London, H.M.S.O.* 1937. 84 *pages* 6/6. (Great Britain—Medical Research Council—Industrial Health Research Board—Report No. 77.)

331. LABOUR

Great Britain—Ministry of Labour and National Service. **"The Worker in Industry: A Series of Ten Centenary Lectures delivered during 1951."** *London, H.M.S.O.* 1952. 106 *pages.* 3/6.

Watkins, Gordon S., and others. **"Management of Personnel and Labor Relations."** (2nd Ed.) *N.Y., McGraw-Hill.* 1950. 974 *pages. Charts.* £2 19s. 6d.

331.124 FOREMANSHIP; SUPERVISION

Gilbreth, Lillian M., and Cook, Alice Rice. **"The Foreman in Manpower Management."** *N.Y., McGraw-Hill.* 1947. 199 *pages.* $2.50. (Industrial Organization and Management Series.)

331.5 SPECIAL TYPES OF WORKERS

International Labour Office, Geneva. **"The Training and Employment of Disabled Persons: A Preliminary Report."** *Montreal, I.L.O.* 1945. 302 *pages.* 6/–. (Studies and Reports; series E, The Disabled, No. 7.)

338. ECONOMICS; PRODUCTION

Allen, G. C. **"British Industries and Their Organization.** (3rd Ed.) *London, Longmans Green.* 1952. 289 *pages.* 17/6.

389.6 STANDARDIZATION

American Standards Association. **"Dollar Savings through Standards by American Industry."** *London, Mutual Security Agency, Productivity and Technical Cooperation Division.* [1952.] 32 *pages.*

425. ENGLISH GRAMMARS

Day, Stanley, and Wiltshire, S. H. **"An English Course for Royal Society of Arts and Technical Students."** *London, Macdonald & Co.* 1952. 164 *pages.*

510. MATHEMATICS

Kármán, Theodore v., and Biot, Maurice A. **"Mathematical Methods in Engineering: An Introduction to the Mathematical Treatment of Engineering Problems."** *N.Y., McGraw-Hill.* 1940. 505 *pages.* £1 4s.

600. APPLIED SCIENCES; TECHNOLOGY

Masters, Samuel. **"Essays on Technology and Other Subjects appearing in 'The New Era,' Deep River, Connecticut."** *Deep River, Curtiss Johnson Publications.* 1951. 55 *pages. Mimeographed.*

607. RESEARCH

National Physical Laboratory, Teddington. **"Report for the years 1940-1945, 1951."** *London, H.M.S.O.* 1952.

614.8 PREVENTION OF ACCIDENTS; SAFETY MEASURES

Great Britain—Joint Standing Committee on Safety in the Use of Power Presses. **"Fencing of Press Brakes: Report of the Committee."** *London, H.M.S.O.* 1952. 15 *pages. Illustrated.* 1/3.

Great Britain—Law, Statutes, etc. **"Guide to the Principal Safety Requirements of the Factories Acts 1937 and 1948."** (2nd Ed.) (Rev.) *London, Royal Society for the Prevention of Accidents.* 1951. 90 *pages.* 15/–.

Great Britain—Ministry of Labour and National Service—Factory Dept. **"Safety of Machine Tools and Other Plant, Nos. 1-4."** *London, H.M.S.O.* 1944–1952. 4 *Parts. Illustrated. Diagrams. Contents:* No. 1, Drilling machines. 1950. No. 2, Horizontal milling machines. 1950. No. 3, Drop hammers. 1944. No. 4, Guillotines and shears. 1952.

Newbold, E. M. **"Contribution to the Study of the Human Factor in the Causation of Accidents."** *London, H.M.S.O.* 1926. 75 *pages. Graphs.* 7/6. (Great Britain—Medical Research Council—Industrial Fatigue Research Board—Report No. 34.)

621.357 ELECTRO-DEPOSITION; ELECTRO-PLATING; ELECTRO-FORMING

Wesley, W. A., and Prine, W. H. **"Practical Nickel Plating."** *N.Y., International Nickel Co. Inc:* [n.d.] 44 *pages. Illustrated.*

The Library Members are asked to note that the Library will be open between 10 a.m. and 5.30 p.m. from Monday to Friday each week, and from 9.30 a.m. to 12.30 p.m. on Saturdays. Due to Meetings, the full facilities will not be available at the following times:

Tuesday, 9th September, from 2.30 p.m.
Thursday, 11th September, from 11 a.m.
Tuesday, 16th September, from 11 a.m.
Thursday, 18th September, from 4 p.m.

Journal Binders Members are reminded that binding cases for the Journal are obtainable from Head Office, price 7/6 each post free. The cases, each of which will hold 12 issues of the Journal, are made of stiff board covered with imitation leather cloth, with gilt lettering on the spine.

Research Publications A number of copies of the following Research publications are still available to members, at the prices stated:

Report on Surface Finish, by Dr. G. Schlesinger	15/6
Machine Tool Research & Development	10/6
Practical Drilling Tests	21/-
Test Charts for Machine Tools, Parts 3 and 4	6/- each

These publications may be obtained from the Production Engineering Research Association, "Staveley Lodge," Melton Mowbray, Leics.

Issue of Journal Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

Important In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

ASSOCIATE MEMBERSHIP EXAMINATION, 1952
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HAZLETON MEMORIAL LIBRARY, 1950-1952

IT is a story of growth and development—slow but steady—since the Hazleton Memorial Library was formally opened on 26th October, 1950. The Library Committee have been acquiring books and periodicals from all parts of the world, and have been concentrating on making an effective technical information service available to members of the Institution.

The Library stock is now approximately 1,000 volumes and 1,000 pamphlets; 170 periodicals are received regularly. The chief Library services are:—

1. The loan of material, and its despatch by post where necessary.
2. The provision of information on a wide range of production engineering subjects.
3. The negotiation of loans from other libraries when the required material is not in the Hazleton Memorial Library.
4. The compilation of bibliographies.
5. Arranging for photoprints of technical articles.
6. Maintaining contact with the Scientific Film Association, and other sources of technical films.

Enquiries received, therefore, range from requests for a particular title or issue of a periodical to the identification of a little known trade name; from the verification of an obscure reference to all possible information on some new or little used process.

This growth in the scope and use of the Library has necessitated an extension of the Library accommodation. Council have sanctioned the erection of two large bays of shelving in the Council Room at 36 Portman Square. Most of the books, as distinct from pamphlets and periodicals, can now be housed there, and the room be used as a Reading Room, except when Meetings are in progress. These are mostly in the evening, so that the use of the Room by the Library is hindered very little. In future, however, the dates and times on which the *full* facilities will not be available on account of Meetings, will be included in each issue of the Journal.

In addition to this increased accommodation for books and readers, the Library hours are to be extended. Commencing on 6th September, the Hazleton Memorial Library will be open on Saturdays, from 9.30 a.m. to 12.30 p.m., except during public holiday periods, such as Easter, Whitsun, August Bank Holiday, and Christmas.

It is hoped that as many members as possible from the London area and beyond will take advantage of these improved facilities. Much can be done by letter and telephone, but in such cases, the most important thing, the choice of material, has to be left to the Library staff. Though willing, they are not omniscient, nor are they mind-readers, and their best efforts are no substitute for personal reference to a wide range of material, for comparing one book with another, one article with another.

Requests from members have led to this extension of Library hours, and the Committee hope that increased use of the valuable facilities provided will be made. However, they ask members to remember one thing, Enquiries which are outside the normal production engineering field, or which are about newly developed or somewhat specialised processes, cannot always be answered in five or ten minutes. If the Library staff can be given notice of such a request by letter or telephone, material can be located in advance, and time thus saved.

FATIGUE OF METALS

by PROFESSOR J. A. POPE, Ph.D., D.Sc., Wh.Sch., A.M.I.M.E.*

Presented to the Nottingham Section of the Institution, 3rd October, 1951

THE fatigue strength of a metal is probably one of its most important mechanical properties. In nearly all cases of dynamic loading at normal temperatures it is, directly or indirectly, the limiting factor in design. It is quite impossible to deal adequately with the subject in one lecture and, therefore, this paper is an endeavour to deal with what seems to the author the more important aspects of the subject. The paper is divided into two parts; the first deals with the fundamental principles of the fatigue failure and the second, factors affecting the fatigue strength. In this latter section, considerable consideration will be given to the importance of the condition of the metal surface.

Methods of improving the fatigue strength of metals will be discussed but, again due to shortage of time, the effect of shot peening only will be dealt with at all fully and only passing reference made to surface rolling and nitriding. The effect of size on fatigue strength will not be discussed as, at the moment, the picture is confused. It is generally thought, however, that up to, say, one inch diameter, the larger the specimen the lower will be the fatigue limit.

Nomenclature

$\pm P$ = Range of oscillating direct stress.
$\pm P_f$ = Range of oscillating direct stress at fatigue limit.
P_μ = Mean value of direct stress.
P_r = Fatigue limit when $P_m = 0$.
P = Oscillating tensile load.
P_m = Mean tensile load.
P_y = Yield strength tension.
P_u = Ultimate strength tension.
q = Shear stress.
q_y = Yield strength torsion.
q_u = Modulus of rupture for torsion test.

Fatigue Limit

It was first indicated by Sir William Fairburn in 1860 that the stress which a metal will stand being applied and removed an infinite number of times without fracture is much less than the fracture strength of the metal under static load, indeed in most cases it is less than the initial yield stress of the metal.

* *Head of Department of Civil and Mechanical Engineering, University of Nottingham*

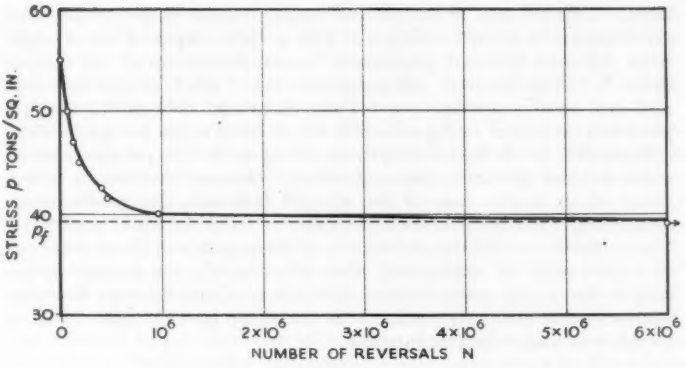


Fig. 1.

If a series of specimens is subjected to alternating tension and compression stresses, the stress range being defined as $\pm P$, the value of $\pm P$ for the first specimen being chosen so that fracture is produced and each subsequent specimen being tested at a stress range slightly less than the previous, eventually a stress range is obtained which will not cause fracture. By plotting the stress p against number of reversals N a curve is obtained as shown in Fig. 1, in which P_f (the stress which will just not produce fracture) is defined as the fatigue

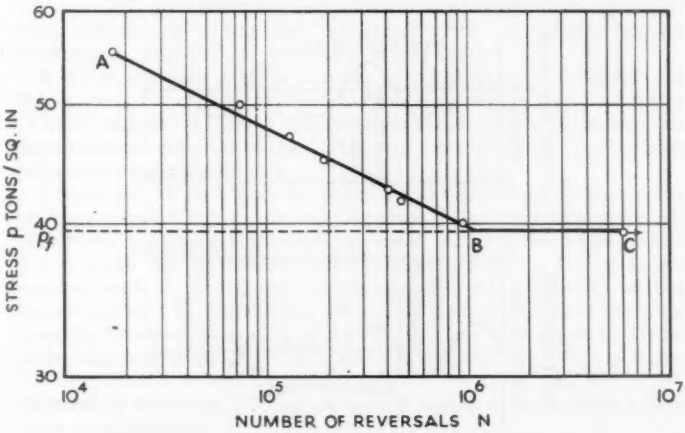


Fig. 2.

limit. Often P and N are plotted to logarithmic scales which then gives the curve shown in Fig. 2. This graph consists of two straight lines AB and BC and provides a better definition of the fatigue limit P_f. The portion AB represents the "life" of the material and is a very important part of the diagram. Many engineering parts are no longer being designed for an infinite life but quite often a finite life is all that is required, since, with the present rate of technological advance, many products become obsolete in a few years or, as in the case of the aircraft industry, the performance demanded is so high that the acceptance of a limited life is inevitable. Under these conditions an estimate of the number of stress reversals in a part must be made, and, instead of basing the design on the fatigue limit, the stress which will just produce fracture for that number of reversals is used. It is therefore portion AB of Fig. 2 which is of value for this purpose.

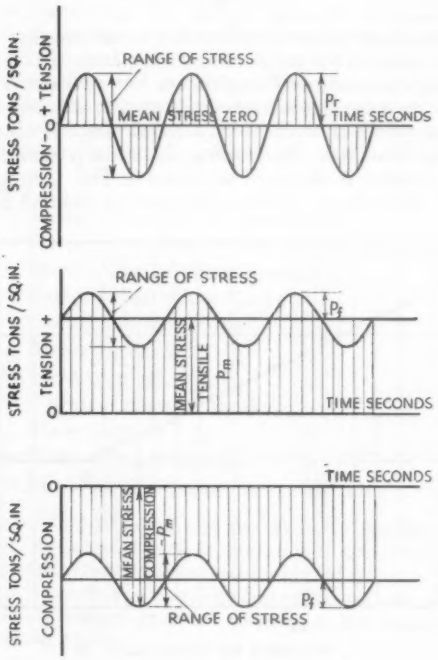


FIG. 3

Returning now to the fatigue limit P_f. It is not sufficient to state that P_f is the fatigue limit of the metal since it does not completely define the stress conditions. There may be superimposed upon this oscillating stress $\pm P$ a steady stress P_m, called the "mean stress," which may be either positive or negative. Thus the complete range of stress is from $P_m - P$ to $P_m + P$. The case when the stress range is $\pm P$ is a special one when $P_m = 0$ and the fatigue limit under this condition will be called P_μ. The stress cycles for various mean stresses are shown in Fig. 3.

Gough[1]* has examined the nature of the spread of fatigue failure in some detail and the picture obtained is briefly as follows:—

At some point, before the yield point can be determined by external measurement, local yield actually takes place in a crystal or at a grain boundary (there are many imperfections in even a pure metal which give rise to stress concentrations). Due to the applied oscillating stress, considerable slip takes place at the edges of the crystal, the quantity of slip increasing until the edges of the grains under the microscope appear to be covered with black patches which are really a large number of highly concentrated slip bands. If these black areas spread beyond a certain amount, then the fatigue crack is propagated and fracture will result, but if the applied stress is not too great, these slip bands will eventually cease to spread, the metal stabilises itself, and failure will not occur.

Orowan's Theory

A theory of fatigue failure has been put forward by Orowan[2] which, in the author's opinion, is the most compatible with the experimental evidence available. An understanding of the conceptions of this theory is most helpful in estimating the significance of certain fatigue phenomena, and will be explained briefly below.

A metal contains a large number of inherent imperfections. In Fig. 4 these have been represented as being equivalent to a series of small cracks. Under a tensile stress these will cause stress concentrations at the ends of the cracks and a certain amount of plastic deformation will take place.

The metal, in fact, may be regarded as equivalent to the spring system shown in Fig. 5. In this diagram, A is a very strong spring, of stiffness K, which represents the main body of the metal; while B is a weak spring in series with a plastic body C; B and C are parallel with A and represent the stress-strain conditions at the imperfections. B and C contribute very little to the load carrying capacity of the system and whatever changes take place in C the deflection due to load $\pm P$ will be $\pm X$ where $X = \pm \frac{P}{K}$. It is the alternating strain of $\pm X$ on sections B and C of the system which have to be studied.

* Table of references given in Appendix I at end of paper.

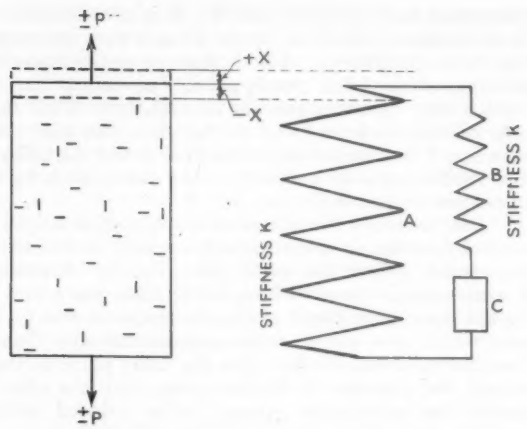


Fig. 4. Fig. 5

Let the stiffness of the spring B equal k and the plastic strength of C be f. Then the spring B will deform $\frac{f}{k}$ before C suffers any deformation, if $\frac{f}{k} \geqslant X$, C will not deform at all; if $\frac{f}{k} < X$ then, at every application of the load, C will suffer plastic deformation. If, however, C has the ability to work harden, as deformation continues, the value of f will increase and eventually a value will be reached when $\frac{f}{k} = X$ and no further deformation will occur under the alternating strain $\pm X$. If, however, C cannot work harden to this extent, eventually the deformation will be so great that C will fracture. It will be remembered that B and C together represent the highly stressed area at the imperfections, therefore the fracture of C is analogous to the propagation of a crack from the ends of one or more of these imperfections (i.e. the initiation of a fatigue failure).

The whole process may be represented graphically as shown in Fig. 6. In this diagram the curve OD represents the work hardening characteristics of the metal (stress strain diagram to some scale) and OE the loading line for the spring B, the slope of which, of course, equals k. Mark off along the abscissa a distance to represent X and through that point draw the vertical line FG cutting OE at H. Finally, through D draw a horizontal line cutting FG at J. If H lies below J, then it means that the metal around the imperfections

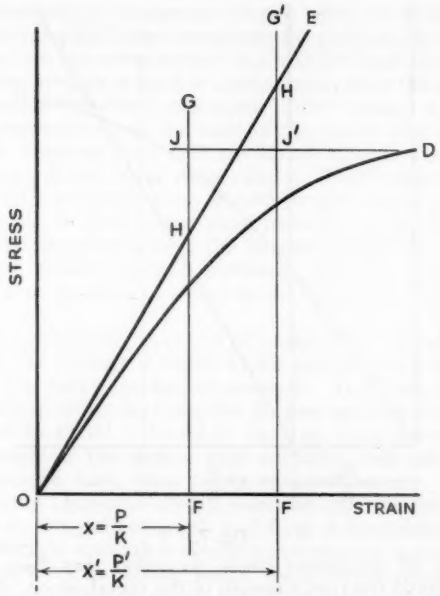


Fig. 6.

can eventually work harden to such an extent that no further deformation will take place and the metal becomes stabilised. This is the case for J and H. If, however, the applied load on the specimen is increased from P to P^1 the deflection increasing from X to X^1 (note $X^1 = \frac{P^1}{K}$) points F^1, J^1, H^1, and G^1 are obtained, Fig. 6, and in this case H^1 lies above J^1 and failure would occur. Thus the load $\pm P$ would not produce fatigue failure but the load $\pm P^1$ would exceed the fatigue limit and produce failure. Fig. 6 is, of course, qualitative rather than quantitative, but it gives a very useful picture of the fatigue phenomenon.

Applying a Mean Stress

It is interesting, using Orowan's theory, to examine what theoretically should be the effect of a mean stress. The effect of applying a mean stress is simply to move the axis of the curve over a distance Y, Fig. 7, where $Y = \frac{P_m}{K}$ (P_m = mean load). It follows, therefore, from Fig. 7, that the range of stress which may be applied to a metal should be

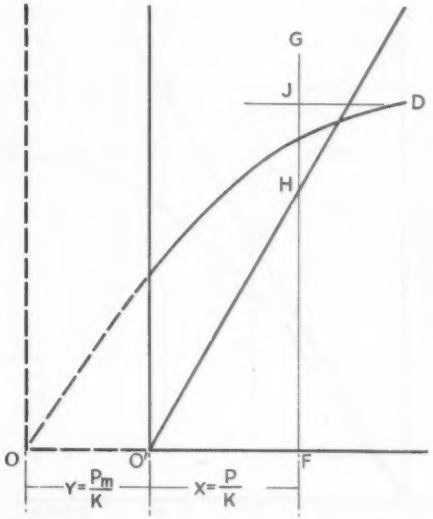


Fig. 7.

independent of the mean stress, provided that $P_m + P$ does not exceed the static fracture strength of the metal, since, although the axis of the curve is moved to the right by the application of a mean stress, the relative positions of points J and H remain unchanged.

Actually, when discussing the effect of mean stress, this will be shown to be true for polished specimens subjected to torsional stress.

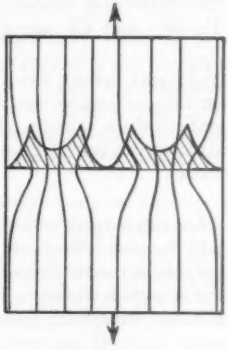


Fig. 8a.

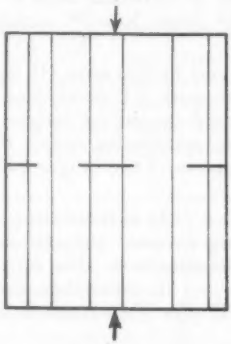


Fig. 8b.

When considering a compressive mean stress (or oscillating compressive stress) another factor dominates the picture. In many ways, the imperfections in a metal behave in a manner equivalent to minute cracks. Under tension, a crack is a stress raiser since the stress cannot " flow " through the crack and must " flow " round it, giving rise to stress concentrations at the ends of the crack, Fig. 8a. Under compression, however, very fine cracks are able to transmit stress and therefore will not act as stress raisers. This being the case, the fatigue strength in compression should be very much greater than in tension; this, in fact, is the case, indeed it is the fundamental reason for the improvement of the fatigue properties of metals by shot peening, surface rolling, nitriding, and the reason for the superior fatigue qualities of rolled screw threads over machine cut threads.

Referring again to Fig 6, it will be noted that it is the strength at point D, i.e. the rupture strength of the metal, which is one of the main factors in fixing the fatigue strength. It follows then, that if any relationship exists between the fatigue strength and the static properties of the metal it should be the true static rupture strength. Efforts to correlate the fatigue limit with the yield strength or the ultimate strength have been made without success. This is not surprising since Orowan's theory indicates that the fatigue limit is not related to the yield strength and from a fundamental point of view, the ultimate strength is almost a meaningless quantity, related to the rate of work hardening rather than anything else.

In the masses of fatigue results which are available, the true static rupture strength of the metal is rarely given, and therefore a huge fatigue testing programme would be necessary before the correlation between fatigue strength and the true static rupture strength would be possible.

The Effect of Mean Stress

Smith[3] has carried out an extensive survey of all the important fatigue results, and has endeavoured to derive empirical relationships between fatigue strength and mean stress for various systems of stressing and for both polished and notched specimens. Figs. 9, 10, 11 and 12 are derived from his results. There is a considerable amount of scatter in the fatigue results, and the shaded areas on these diagrams represent the areas covered by the experimental points considered. The parameters plotted vary according to the stress system under consideration and the reader is advised to note the nomenclature carefully when studying these diagrams. The results for notched specimens are most important since a notch is virtually defined as anything which is not polished. Furthermore, most manufactured parts have discontinuities, due to their geometrical shape, which are just unavoidable. (For example, oil holes

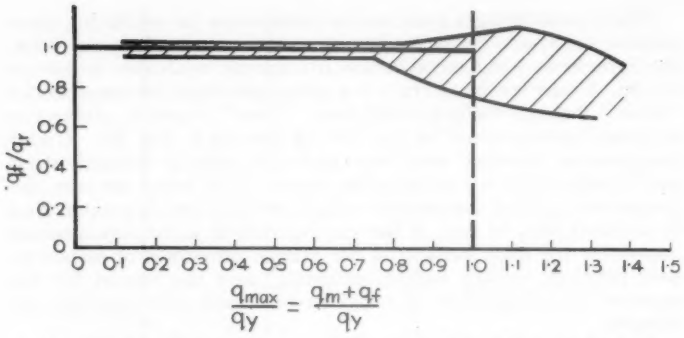


Fig. 9. Effect of mean stress on fatigue strength (polished specimens).

and grooves.) The polished specimen condition in practice is the exception rather than the rule.

Fig. 9 shows the effect of mean stress upon polished specimens subjected to torsional fatigue. It will be noted that the range of alternating stress which may be applied is independent of the mean stress until the yield stress has been reached (i.e. $\frac{q_{max}}{q_y}=1$), which is in accordance with the predictions based on Orowan's theory. The same does not apply to notched specimens, Fig. 10. In this case, the safe range of stress decreases as the mean stress increases. For both polished and notched tensile specimens the safe range

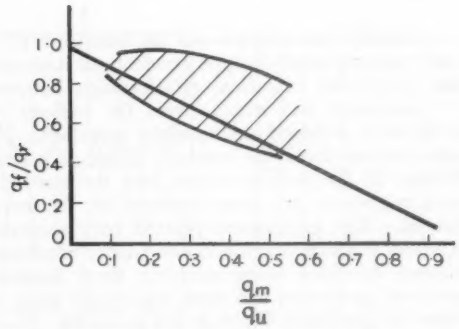


Fig. 10. Effect of mean stress on fatigue strength (notched specimens).

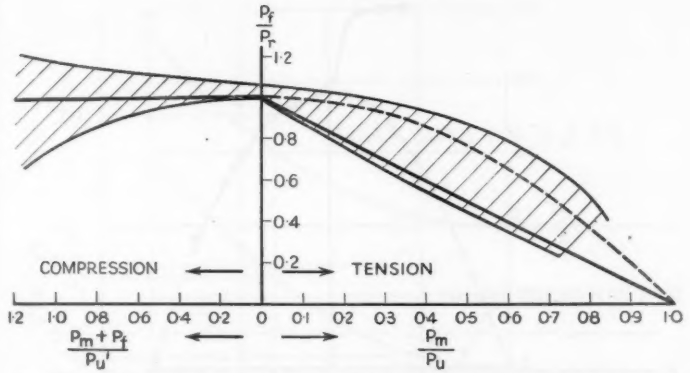


Fig. 11. Effect of mean stress on tensile fatigue, polished specimens (after Smith). The shaded portion is the area covered by experimental points.

decreases as the tensile mean stress increases, (Figs. 11 and 12 respectively). When, however, the mean stress is compressive, the safe range of stress remains constant for polished specimens; while for notched specimens the value of the safe range of stress increases rapidly as the compressive mean stress is increased. This is in

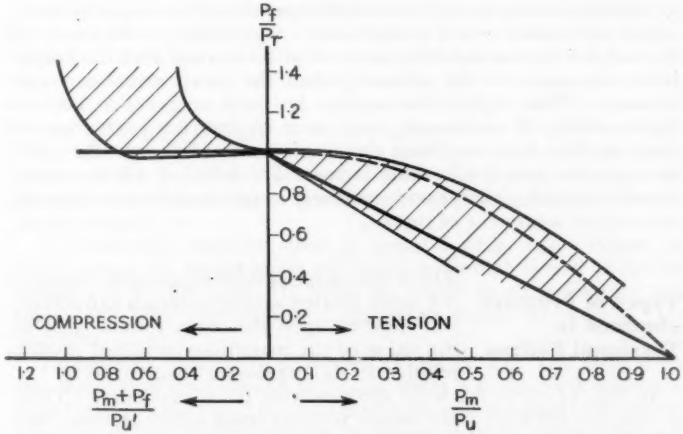


Fig. 12. Effect of mean stress on tensile fatigue, notched specimens (after Smith). The shaded portion is the area covered by experimental points.

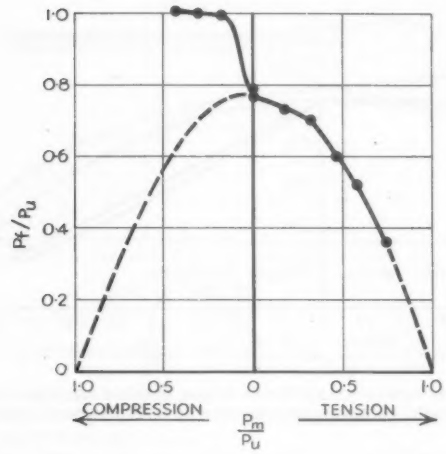


Fig. 13. Effect of mean stress on the tensile fatigue limit for normalised mild steel.

keeping with the conclusions drawn from theoretical considerations. Some experimenters have found from their metals, even when a polished specimen is used, a marked improvement in fatigue strength when the mean stress is compressive. Fig. 13 shows the results of Brown[4] for normalised mild steel. It will be noted that the fatigue limit was equal to the ultimate when the mean stress was compressive. This high value cannot be used in practice because deformation will occur and, since most engineering parts must be designed for freedom from deformation, in this case the yield strength becomes the limiting factor. The effect of a compressive stress is most remarkable and extremely important when considering the surface treatment of metals.

Types of Fracture obtained in Torsional Fatigue

The actual shape of the fatigue curve obtained (i.e. stress plotted against reversals to fracture) will depend upon the stress system, that is, the value of the maximum principal stress p relative to the maximum shear stress q.

In Fig. 14 curve AB is for the condition $p=q$, and curve CD for $p > 2q$, i.e. AB is for pure torsion without stress concentrations, and CD for either tension, with or without stress concentrations, or torsion with stress concentrations.

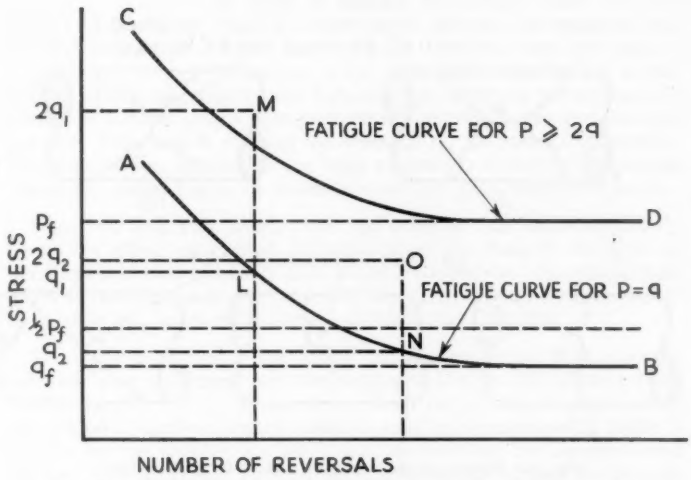


Fig. 14. Effect of stress concentrations on torsional fatigue strength.

It will be remembered that in pure torsion the maximum tensile stress, ' p ', is equal to the maximum shear stress, ' q ', and that the latter acts on planes parallel, or at right angles, to the axis of the specimen. A fatigue crack, if the stress is above the fatigue limit and there are not initial stress concentrations other than those intrinsic to the metal, will develop on one of these planes, but this crack will at once cause a stress concentration, which in turn will create a tensile stress ' p ' > 2q (i.e., more than double in value). Thus whether the fracture continues to follow the maximum shear plane or the helicoidal plane of maximum principal stress will depend upon which stress cuts the corresponding fatigue curve at least reversals.

For example, consider stress q_1 (point L, Fig. 14). When the crack occurs the tensile stress will equal $2q_1$ which is well above the tensile curve CD (point M), with the result that the fracture will follow the helicoidal planes of maximum tensile stress (Figs. 15a and 15b.

If, however, a stress q_2 is applied (Point N, Fig. 14), then when the initial crack occurs the principal stress p is doubled, becoming equal to $2q_2$, point O. In this case O lies below curve CD and the fracture will be circumferential as shown in Figs. 15c and 15d.

This change in mode of fracture has been obtained by the author when testing hardened and tempered carbon steels. If the fracture

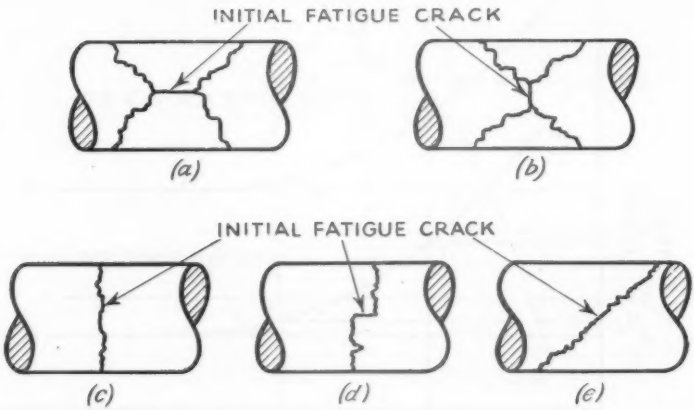


Fig. 15. Various types of fatigue fracture for pure torsion.

is of the type shown in Figs. 15a or 15b then the metal has been stressed well in excess of its fatigue limit; if of the type shown in Figs. 15c or 15d the stresses have been lower. If the fatigue crack is initiated by the principal stress, then the type of fracture will be that shown in Fig. 15c.

Effect of the Condition of the Metal Surface upon the Fatigue Strength

The condition of the metal surface has a profound effect upon the fatigue strength, particularly in bending and in torsion when the maximum stress occurs at the surface, and it must be remembered that bending and torsion are the most common types of stressing met with in engineering.

Surface Finish

The effect of surface finish upon the fatigue strength is shown in Fig. 16 (after Moore and Kommers[5]). From these results it appears that a metallurgical finish gives 10 per cent. more strength than a ground finish, and rough turning 10 per cent. less than the ground finish. Taking the fatigue strength obtained with the metallurgical finish as the absolute strength of the material, then 20 per cent. of the strength is lost by having a rough turned finish.

Effect of Surface Decarburisation

If steel is heated in contact with oxygen (usually atmospheric oxygen) at temperatures above about 750°C. two processes are active: (i) carbon is lost from the surface of the metal which, of course, reduces the fundamental strength of the surface material, and (ii) the oxygen penetrates the grain boundary causing a notch effect which reduces the strength of the metal still further. Decarburisation occurs during heat treatment and in all processes where the metal has to be heated in contact with the atmosphere.

Figs. 17a and 17b, taken from the work of Gill and Goodacre[6], show the effect of carbon content upon the fatigue strength of decarburised and polished steel wires respectively. A comparison of these two diagrams shows clearly the great loss of strength which may arise due to decarburisation of high carbon steels.

If a number of fatigue specimens are heat treated so that a decarburised layer is formed and the fatigue value, or life, obtained for various degrees of metal machined from the surface, a measure of the effect of surface decarburisation can be determined. Table I shows the results of a few such tests carried out by Hankins and Becker[7], in connection with which it may be added that the fatigue limit for a completely polished Si-Mn specimen was ± 46 tons per sq. in.

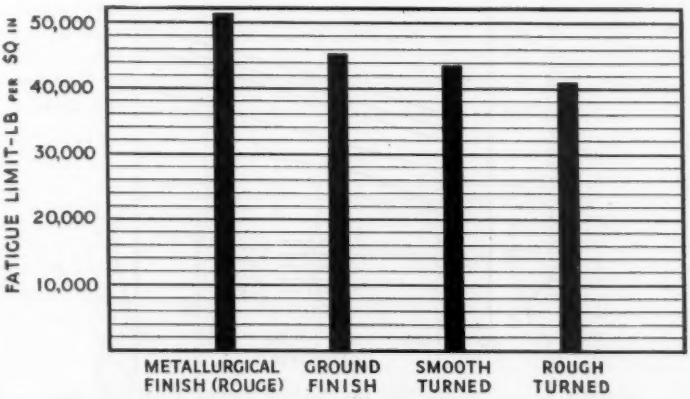
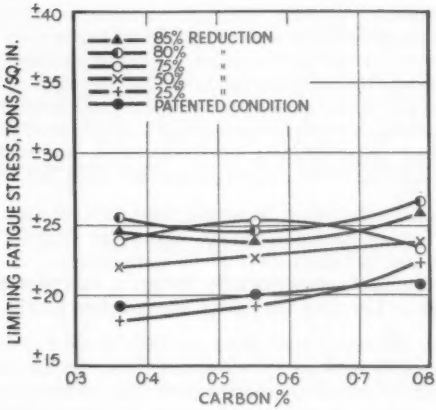
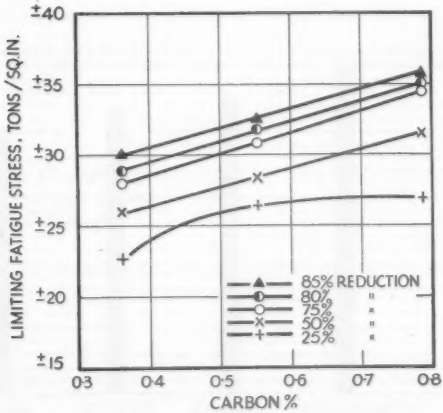


Fig. 16.



Effect of carbon content on the limiting fatigue stress of wires drawn from decarburised lead-cooled patented rod.

Fig. 17a.



Effect of carbon content on the limiting fatigue stress of wires drawn from lead-cooled patented rods free from decarburisation.

Fig. 17b.

TABLE I

Material and Heat Treatment	Depth of Surface removed ins.	Stress Tons/ sq. in.	No. of Reversals Millions
Si-Mn Steel O.Q. 950°C.	0	±26	10·00 Unbroken
		±30	0·22 Broken
T 500°C. Furnace	0·0001	±34	0·22 Broken
Vacuum Pressure = 1 mm. Hg	0·001	±35	4·20 Broken
	0·0025	±37	7·00 Unbroken
		±41	6·24 Broken

Fig. 18 shows diagrammatically the strength distribution, relative to diameter, in a decarburised bar. Due to decarburisation, and the probable addition of surface defects, the strength at the surface of the bar has been reduced from AD to AB and thus the load carrying capacity of the rod by the same ratio. The load "potential" of the metal is represented by the rectangle ADEO but, due to the non-linear stress distribution in torsion or bending, even with no decarburisation, it is reduced to triangle ADO. When decarburisation is present, there is a further reduction to the smaller triangle ABO, which represents only a small fraction of the total potential of the metal. It will be noted that it is the surface condition and not the depth of decarburisation that determines the strength of the bar and thus a small decarburised layer is almost as detrimental as a large one.

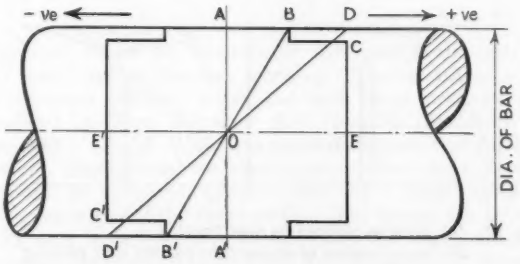


Fig. 18. Strength of decarburised bar.

Effect of a Compressive Mean Stress

It has already been shown that a compressive mean stress will increase the fatigue strength of a metal, and the method of neutralising the effect of decarburisation is to induce into the surface of the metal a residual compressive stress. The most convenient method of doing this is shot peening (i.e. impacting the surface of the metal with cast iron shot travelling at high velocity). Due to the peening process the surface of the metal tends to spread, but is prevented from doing so by the inner layers of the metal with the result that the surface has residual compressive stresses while the core of the metal is in tension. Fig. 19a shows diagrammatically the stresses induced by shot peening.

Shot peening and Stresses Induced

The value of the induced stress at the surface is usually adequate to neutralise the decarburisation effect there, but, as will be shown later, the important factor is that the compressive stress should penetrate to a depth greater than the effect of decarburisation.

In Fig. 19b the effect of shot peening has been just correct, and

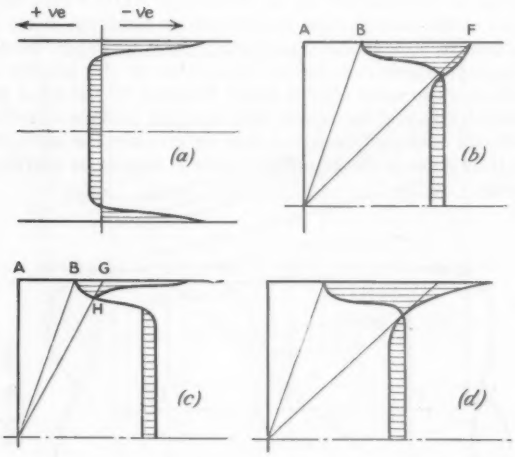


Fig. 19. (*a*) Stresses induced by shot peening.
(*b*) Improvement of strength by correct shot peening.
(*c*) Insufficient shot peening—little increase in strength.
(*d*) Excessive shot peening. Strength same as Fig. 19 (*b*).

the fatigue strength has been increased from AB to AF. In Fig. 19c the effect of the shot peening has been insufficiently deep and the increase in strength has only been BG.

The point where fatigue failure will initiate is that point on the strength line which is tangential to the stress line, i.e. point H. The degree of shot peening has been excessive in Fig. 19d and only a very small gain has resulted from the extra peening.

The conditions shown in Figs. 19c and 19d would give rise to sub-surface failure. A typical sub-surface failure is shown in Fig. 20.

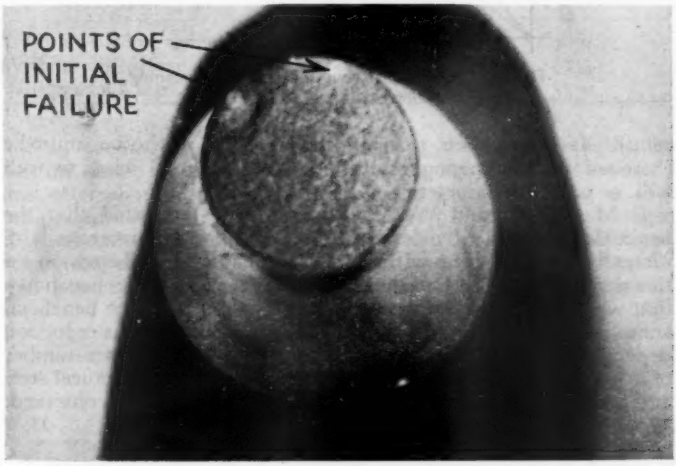


Fig. 20.

Zimmerli[8] found an increase in the fatigue strength of about 40 per cent. due to the shot peening of valve springs made from small diameter polished wires, but such large increases would not be realised in large diameter rods (usually maximum of about 20 per cent.). A. M. Wahl has similarly shown that for his " small diameter " shot peened steel spring specimens, the fatigue strength was about 20 per cent. greater than for " large diameter " shot peened specimens of the same metal. The reason for this size effect may be seen from Fig. 21. In this case, the depth of compression due to shot peening can be as much as one-quarter of the wire radius with a corresponding increase in strength from AD to AJ (33 per

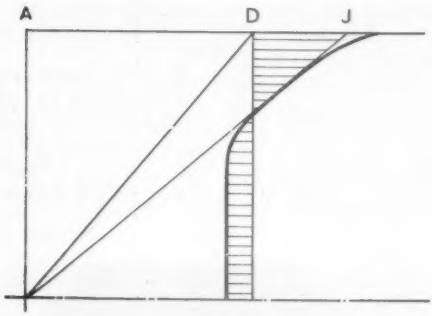


Fig. 21. Increase in strength due to shot peening small polished wires.

cent.). It follows then, that a certain amount of caution must be exercised when applying results obtained on small wires to rods $\frac{1}{2}$ in. or more in diameter.

J. M. Lessells and W. M. Murray[9] have indicated that the beneficial effects to be derived from shot peening increase with increase in the hardness of the metal, see Table II. The reason for this may be obtained from the work by H. F. Moore who has shown that when oscillating stresses are applied to soft iron, the beneficial compressive stresses due to shot peening are reduced, this reduction depending upon the magnitude of the stress applied and its number of applications. When, however, he carburised the structural steel and heat treated it to about 520 Brinell, no such effect was observed.

TABLE II

Material	Brinell Hardness No. approx.	Per cent. Increase in Fatigue limit due to shot peening
Armco Iron	120	1
S.A.E. 1045 Annealed	165	11
S.A.E. x 4340 Q. & T.	278	18

At this point it must be made clear that the gain in fatigue strength by the shot peening of polished specimens (the average increase being usually about 10 per cent. to 15 per cent. for specimens of about $\frac{1}{2}$ in. in diameter), is not nearly so great as that obtained by the shot peening of " as received " bars. If, however, the surface

defects are deep, e.g. rokes or laps, the shot peening has a much reduced effect. To illustrate this, the results of Lupfert[10] are shown in Table III from tests on helical springs of hardened steel wire, 0·118 in. diameter.

TABLE III

Condition of Wire	Torsional Fatigue Strength Tons/sq. in.	
	Not Shot-peened	Shot-peened
Without surface defects	34·1	48·2
With small surface defects	20·8	47·5
With surface laps	21·3	35·0

Shot peening gives no improvement to the static strengths, in fact the elastic limits in torsion and bending are sometimes lowered, and after shot peening it is desirable to give the spring a low temperature heat treatment to bring these properties back to their original value. This heat treatment also improves the fatigue strength of the steel, as shown in Fig. 22 by curve C (due to Lessells and Murray) which indicates an increase in the fatigue limit of

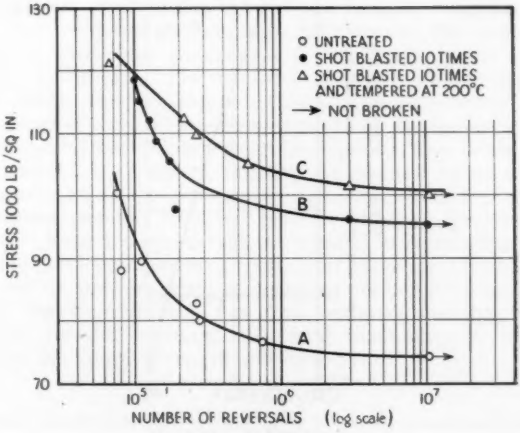


Fig. 22.

7 per cent. above curve B, by tempering at 200°C. for 20 minutes.

So far we have only discussed shot peening as a method of improving the fatigue strength. Similar compressive surface stresses may be obtained by surface rolling or nitriding, the former being very convenient for certain machined components as the surface is not so badly damaged. Nitriding is probably by far the most reliable method of producing compressive surface stresses, but it has the disadvantage of being expensive and as the nitrided surface is very hard, if components are roughly handled, it is liable to be easily damaged. However, the mechanism, from the point of view of improvement of the fatigue strength, is much the same for all methods.

Effect of Grinding

The effect of grinding is not consistent, but usually bad. During grinding the surface becomes very hot at the instant of abrasion and compressive stresses are set up resulting in plastic deformation. It is then suddenly cooled by conduction to the large mass of surrounding metal,

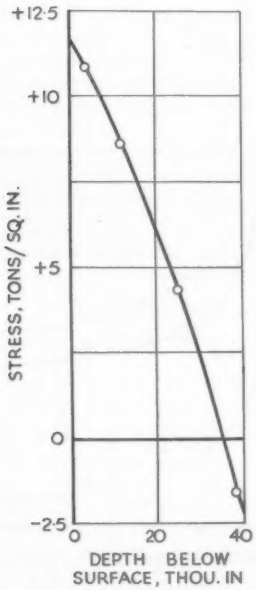


Fig. 23. Stresses due to grinding

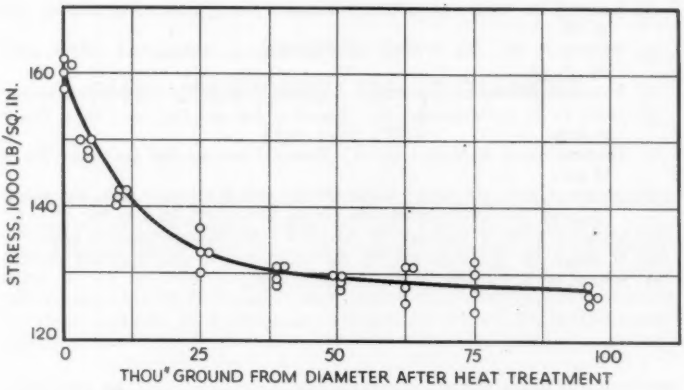


Fig. 24. Reduction of fatigue strength due to grinding.

producing a residual tensile stress at the surface, which, of course, reduces the fatigue properties considerably. Fig. 23 shows the internal stresses induced by grinding, while Fig. 24, due to Boyer[11], shows the reduction of fatigue strength due to various amounts of surface grinding.

Conclusions It may well be that in the future it will be increasingly difficult to obtain adequate supplies of high grade steels and the engineer may be faced with the demand to make the poorer steels work under more and more exacting conditions. The majority of metal failures are due to fatigue, and methods of improving the fatigue properties of ordinary metals is one of the vital problems of our day. If expense is no object and the special steel necessary can be obtained, then nitriding is the best method. If, however, ordinary steels must be used and the process must be an economic proposition, then shot peening deserves the greatest possible attention both by research workers and by industry. Experiments carried out recently at Nottingham University show that if components are required in the machined condition, then ·002 in. may be removed from the surface after shot peening to give the final finish. Far from reducing the improvements produced by shot peening, this final machining in most cases improves the fatigue strength still further.

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Grateful acknowledgment is made to the following authors and publishers for permission to reproduce a number of figures and abstracts used in this paper.

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REPORT OF
THE MEETING OF COUNCIL
24th July, 1952

The First Meeting of Council in the 1952-53 Session was held at 36, Portman Square, London, W.1, on Thursday, 24th July, 1952. Mr. Harold Burke, Chairman of Council, presided over an attendance of 33 members. Also present were Mr. E. H. Y. Burden (Bombay); Mr. B. E. Stokes, Chairman of the Birmingham Graduate Section; and Mr. R. T. Mustard, Chairman of the London Graduate Section.

Election of Standing Committees Council elected the Standing Committees for the 1952-53 Session, and a full list appears on pages 406–408.

Election of Section Hon. Secretaries On the motion of Mr. T. Fraser, seconded by Dr. H. Schofield, the election of Section Hon. Secretaries was confirmed.

Address by Mr. E. H. Y. Burden At the invitation of the Chairman, Mr. Burden, former Hon. Secretary of the Bombay Section, gave a short address on the progress of Institution activities in India.

In conveying the greetings of the Indian Sections to Council, and stressing their wholehearted support of the Institution, Mr. Burden said that he was very grateful to Council for the invitation to attend the meeting. This gesture would be sincerely appreciated by the members in India.

Finance The Secretary referred to the Income and Expenditure Account for 1951-52 and the Proposed Budget for 1952-53, and drew Council's attention to the fact that the 1951-52 Budget had proved to be very accurate. There was a small increase in administration charges, due mainly to increased postage rates. Salaries and pension contributions were slightly less than the budget, due to the fact that a Technical Officer had not yet been appointed. Expenditure on the Journal and Proceedings was within the budgeted figure.

Income had improved during 1951-52. This was due to the increased membership and to the recent increase in advertising rates, from which the Institution was now beginning to derive

benefit. Although the figures were subject to audit, there was no doubt that the Institution would have a surplus of income over expenditure in excess of £2,000. This would enable Council to transfer £2,000 to the New Building Fund.

Turning to the Budget for 1952-53, the Secretary said that the main difference was the inclusion for the first time of an allocation to the Library. Up to this year the Library had existed on the fund contributed by members, but this was now exhausted and the Library must therefore be supported from revenue.

It was anticipated that at the end of the year it would again be possible to set aside £2,000 for the New Building Fund.

Report of Special Committee on Organisation

Following the adoption of this Report at the previous Council Meeting, the Finance and General Purposes Committee were now considering the amendments to the Articles of Association which were involved. Mr. G. R. Pryor, Vice-Chairman of Council, was supervising this work, and it was hoped to present the draft amendments to the Articles of Association to the next meeting of Council, prior to submitting them to the Corporate Membership of the Institution at a General Meeting.

Higher National Certificate in Production Engineering —Institution Prize

Council approved the conditions drawn up by the Education Committee in connection with this award, which will be known as "The Institution of Production Engineers' Prize," and will be awarded to junior members of the Institution during the final year of the H.N.C. course, for outstanding performances achieved in the examinations in the A1 and A2 years.

Lord Austin Prize 1951

Council adopted recommendations by the Education Committee that the Lord Austin Prize for 1951 be awarded to Mr. J. Irwin for his paper on "The Automatic Production of Pressed Glassware," and that Certificates of Merit be awarded to Mr. D. Whitehead and Mr. R. C. Cracknell.

National Foundry College

Mr. J. W. Berry was reappointed the Institution's representative on the Board of Governors of the National Foundry College, and Mr. Berry was thanked for his valuable services in the past.

Membership Mr. H. Tomlinson (Membership Committee) reported that the Committee were at present engaged in revising certain sections of the Confidential Leaflet on Qualifications for Membership, in order to provide better guidance for Section Committees in assessing applications.

Materials Handling Considerable interest in the Institution's activities was shown at the Mechanical Handling Exhibition, Olympia. More than 500 enquiries were received concerning membership. The One-Day Conference organised by the Materials Handling Sub-Committee on behalf of the Institution was very well attended, and the Bibliography on Materials Handling, prepared for the Exhibition, was in great demand.

The Sub-Committee had made considerable progress with their Memorandum, and the Section on Case Studies, which was being prepared in collaboration with the Anglo-American Council on Productivity, would be ready for publication in the autumn. The Sub-Committee wished to record their appreciation of the help received from Local Sections in this work.

Education Discussion Group Council adopted the Education Committee's recommendation that an Education Discussion Group should be formed within the Institution. Facilities would be provided for members to meet regularly or to correspond and exchange views on the teaching of Production Engineering subjects.

All members engaged as full-time or part-time teachers, or interested in teaching, would be eligible to join the Group. (See page 365 this issue).

Visit to P.E.R.A. On the invitation of Sir Lionel Kearns, Chairman of P.E.R.A., Members of Council were joined by members of the Research Committee in an official visit to P.E.R.A. on 25th June, 1952. The party was entertained to luncheon and later toured the workshops and laboratories.

Research The Report on "Work Study—Application and Training" was in the hands of the printers, and would be published in October. (Reference to this Report is made in the August and current issues of the Journal.)

Standardisation It was reported by the Standards Committee that a brief Memorandum asking for the co-operation of teaching establishments in the compilation and use of British Standards had been prepared and circulated to Technical Colleges. The immediate response had been good.

Hazleton Memorial Library The pressure on Library accommodation had now been relieved by the erection of shelving in the Meeting Room, and the Library Committee anticipated greater use of the Library by members calling personally when the improved facilities were made known through the Journal. (See p. 376, this issue.)

International Machine Tool Exhibition, 1952 Through the kind offices of Mr. J. E. Hill, the Machine Tool Trades Association had generously offered the Institution, free of charge, space for a stand at this Exhibition. The F. & G.P. Committee had accepted this offer, and would arrange for the Institution to have a small stand for the use of members and the display of literature. (See p. 366, this issue.)

Local Section Reports Quarterly Reports presented to Council appear on pages 416-429.

Election of Members The list of elections and transfers approved by Council appears on pages 409-415.

Obituary The Chairman reported with deep regret the deaths of the following members; J. I. Armstrong, A.M.I.Prod.E.; O. G. Beere, A.M.I.Prod.E.; T. H. Burnham, A.M.I.Prod.E.; W. H. Brown, M.I.Prod.E.; W. A. Crook, M.I.Prod.E.; T. W. Fazakerley, M.I.Prod.E.; G. W. R. Freebody, A.M.I.Prod.E.; V. H. H. Rollason, M.I.Prod.E.; H. G. Silverston, A.M.I.Prod.E.

Technical and Publications Committee Mr. William Core, referring to the dissolution of the Technical and Publications Committee, said that at a small dinner held by the members of the Committee to mark its winding-up, it had been unanimously agreed to support the Chairman of Council in the work he had undertaken.

Thanking Mr. Core, the Chairman said he understood that Mr. Puckey, the Past Chairman, had intended to pay a tribute to the Committee but had unfortunately been called away from the meeting. Council recorded a vote of thanks to the retiring Technical and Publications Committee for their services to the Institution.

Date and Place of Next Meeting Thursday, 30th October, 1952, at 11 a.m., at 36, Portman Square, London, W.1.

Institution Membership Policy

Council devoted the afternoon session to a detailed discussion on Membership Policy, with special reference to " broadening the base." It was finally agreed, on the Chairman's suggestion, that the Membership and Education Committees, together with the Education Officer and in consultation with Sections, should be asked to prepare a Memorandum on the subject based on the discussion which had taken place.

STANDING COMMITTEES 1952/53

AT the Meeting of Council held on 24th July, 1952, the following were declared elected to serve on the Institution's Standing Committees for the Session 1952/53:

Finance and General Purposes Committee

The Principal Officers:
The President, Sir Cecil Weir, K.C.M.G., K.B.E., M.C., D.L.
The Chairman of Council, Mr. H. Burke
The Vice-Chairman of Council, Mr. G. R. Pryor

Major-General K. C. Appleyard, C.B.E., T.D., D.L., J.P.
R. S. Brown
L. Bunn
E. P. Edwards
B. G. L. Jackman
W. C. Puckey

The Chairmen of all Standing Committees: Editorial, Education, Hazleton Memorial Library, Membership, Papers, Research and Standards Committees.

Editorial Committee

The Principal Officers
L. Bunn
A. A. J. Francis
R. Hutcheson
H. P. Jost
W. C. Puckey
M. Seaman
Each Standing Committee will be asked to nominate one representative to serve on this Committee.

Education Committee

The Principal Officers
F. W. Cooper
F. W. Cranmer
E. P. Edwards
J. France
S. R. Howes
B. G. L. Jackman
K. L. Jackson
C. L. Old
W. E. Park
F. H. Perkins
L. S. Pitteway
R. Ratcliffe
H. Teasdale

Hazleton Memorial Library Committee

The Principal Officers
H. A. Chambers
R. Hutcheson
G. N. Johnson
H. L. Madeley
J. C. Z. Martin
D. H. Mason
R. V. Rider
L. J. Saunders
Rt. Hon. Lord Sempill, A. F. C.
H. G. Shakeshaft
S. R. Smith
G. Cubitt-Smith
R. Thorn
G. C. Twine

Membership Committee

The Principal Officers
H. D. S. Burgess
A. G. Clark
F. W. Cranmer
J. S. Daniels
R. P. Eccles
E. P. Edwards
W. N. Ellerby
J. F. Gibbons
B. W. Gould
R. L. Paice
S. A. J. Parsons
H. Teasdale
H. Tomlinson
F. Whitehead
F. Woodifield

Papers Committee

The Principal Officers
L. Bunn
W. J. T. Dimmock
A. A. J. Francis
R. Hutcheson
H. P. Jost
W. E. Park

Each Section Committee is asked to nominate one Representative to serve on this Committee. Section Representatives who cannot regularly attend meetings of the Committee may be "corresponding" members and can assist in the work of the Committee by the adjudication of Papers and in other similar ways. The following Section Representatives have already been nominated: A. J. Burns (Wolverhampton); F. C. Cooke (Southern); L. R. Evans (Sheffield); B. G. L. Jackman (Birmingham); R. Pryce Jones (Liverpool); and R. H. S. Turner (Manchester).

Research Committee

The Principal Officers
R. B. Beasley
J. H. Bingham
A. J. Bullivant
F. T. Dean
B. H. Dyson
T. W. Elkington
F. G. S. English
R. M. Evans
Dr. D. F. Galloway
J. H. Hartley
P. Holmes
Sir Lionel Kearns, C.B.E.
R. N. Line
Professor T. U. Matthew
S. G. E. Nash
S. W. Nixon
M. Seaman
W. J. Webb

Standards Committee

The Principal Officers

R. K. Allan
J. E. Baty
E. G. Brisch
C. M. Holloway
K. J. Hume
H. Lister
H. L. Madeley
R. E. Mills
C. R. Whitaker
J. R. Widdowson
J. H. Winskill
W. E. Wright

ELECTION OF MEMBERS

July, 1952

The following were elected to membership by Council:—

ADELAIDE SECTION

As Member:
N. B. Hudson.

As Associate Members:
A. H. Ulich, D. W. Wood.

New Affiliated Firm:
Pope Products, Ltd.

New Affiliate Representatives:
A. M. Freestun, N. A. Armfield.

BIRMINGHAM SECTION

As Associate Member:
L. Kew.

As Graduates:
A. T. Cope, A. E. Keeling, K. J. Orton, H. Souster, R. F. Thompson.

As Students:
M. J. Britt, B. J. Hill.

Transfers—

From Associate Member to Member:
W. H. Bazley, E. Kermeth.

From Graduate to Associate Member:
A. H. Hancox, P. E. Hare, N. Newey.

BOMBAY SECTION

As Associate Member:
J. B. Singh.

As Student:
M. R. Garde.

Transfers—

From Associate Member to Member:
J. E. Noble.

From Graduate to Associate Member:
W. G. Boole.

CALCUTTA SECTION

As Member:
C. X. Fernandez.

As Associate Members:
L. G. Berry, C. V. V. Chetti, E. C. Moore, S. N. Paul, L. R. Welch.

As Graduates:
P. W. Doyle, U. P. Karmaker, V. D. Mathur.

As Student:
A. A. Arbab, B. S. Bhatnagar.

New Affiliated Firm:
The Western Manufacturing Co.

New Affiliate Representative:
A. Vaswani.

Transfers:

From Associate Member to Member:
N. N. Sen Gupta.

From Intermediate Associate Member to Associate Member:
V. E. P. Nayar.

From Graduate to Associate Member:
S. K. Niyogi, A. Stirling.

COVENTRY SECTION

As Associate Members:
W. G. Brodie, E. E. Sample.

As Graduate:
S. Chakrabarti.

DERBY SECTION

As Graduate:
J. A. McMorran.

Re-instatement as Graduate:
E. Jackson.

As Students:
W. Allen, D. E. Blant, D. W. Euridge, R. Holyoake, J. S. Lowther.

Transfer—
From Graduate to Associate Member:
J. G. Lynegar.

DUNDEE SECTION

As Member:
A. M. Dent.

EASTERN COUNTIES SECTION

As Associate Member:
J. G. Deal.

As Student:
R. S. Long.

GLASGOW SECTION

As Member:
J. T. Fitzgerald.

As Associate Members:
W. J. Macfeat, H. J. B. Thompson, J. Wark.

As Student:
D. K. Woodburn.

Transfers—
From Intermediate Associate Member to Associate Member:
J. H. McPherson.

From Graduate to Associate Member:
D. H. Topham.

HALIFAX SECTION

As Member:
F. Webster.

As Student:
B. Sutcliffe.

LEICESTER SECTION

As Associate Members:
H. B. Harris, E. Steele, C. Walker.

As Graduate:
E. D. Lodge.

As Students:
I. A. Adesina, M. Ahmad, S. S. Akhtar, Q. R. Ali, A. J. Al-Elewi, B. Al-Mandil, K. Al-Yassin, A. B. Alkhoury, W. R. Anderson, J. S. Amin, I. G. Armour, M. Ashdown, H. K. Baba, A. U. Chaudhri, A. M. Constantinou, J. C. C .Baker-Courtenay, M. A. S. Beg, D. Begounian, R. W. Bond, R. R. B. Bruce, G. M. Byrd, S. I. Davies, A. E. Dreibholz, A. K. M. El-Kamil, M. T. Emmanual, P. C. Fieldsend, H. E. Fisher, P. J. Fowler, J. W. Frakes, J. E. Francis, A. Haider, K. Hamid, J. Hashim, I. Haq, I. M. P. B. Hearn, J. J. Hill, M. S. J. Hollowday, C. F. Holmboe, J. C. Holst, S. M. Husain, J. G. Ivey, S. Z. H. Jafri, L. B. Johansen, W. H. Khan, M. T. Khan, A. F. Knappert, W. H. Kornelis, A. E. Kristiansen, D. J. Lanceman, N. P. Lanitis, M. G. Levy, J. C. Lowey, A. B. Longden, J. W. L. Lundesgaard, M. M. Mahmood, A. M. Malik, M. C. Martin, J. Matthews, W. M. Mills, G. S. Morrish, G. S. Naoum, T. Nygaard, M. L. Osborne, S. Phathong, J. J. Poole, S. N. H. Rizui, M. A. Rizwani, P. G. Robinson, S. Sangmookda, E. F. Simmonds, B. Simpson, J. M. T. Smallwood, P. J. Smith, D. Snowball, R. Stone, S. T. Suckling, C. C. Taliadoros, P. B. Tarratt, P. Uawithya, M. R. Votier, A. R. Welbourne, J. White, J. P. Yeates, A. A. Zuberi.

LINCOLN SECTION

As Member:
G. C. Oram.

As Associate Member:
J. L. Anderson.

As Graduate:
A. R. Choudhury.

Transfer—
From Graduate to Associate Member:
A. H. Needham.

LIVERPOOL SECTION

As Associate Member:
J. W. Brooke.

As Graduate:
L. E. Crisp.

LONDON SECTION

As Members:
W. J. Anderson, D. D. Loweth.

As Associate Members:
E. Bedwell, C. C. Bates, D. M. Callow, K. M. Cook, J. H. Crawford, J. H. Davidson, K. van Heteren, F. W. Hill, J. A. Marston, A. W. Payne.

As Associate:
F. J. Prior.

As Graduates:
W. F. Brade, J. A. Game, A. E. Hinckley, E. C. Lucking, D. L. Morgan, R. W. Morgan, S. J. Sterrett, J. Sewell, A. J. Thame, B. J. Veneear, N. W. Davies.

As Students:
R. A. Ahern, J. L. Blumire, A. E. Budgen, T. Clowry, A. L. Fox, M. Gledhill, J. R. Golding, J. W. E. Gale, E. G. Hammond, B. L. Harris, F. R. Harris, J. F. Hoare, S. J. A. Lageard, I. J. Morris, P. J. Norburn, G. E. Reynolds, P. J. Simner, D. F. Skelton, P. G. L. Scott, D. A. Thomas, R. C. C. Wadey.

Transfers—

From Associate Member to Member:
P. H. W. Everitt, L. F. Hoeniss.

From Intermediate Associate Member to Associate Member:
S. J. Edwards.

From Graduate to Associate Member:
J. Irwin, C. Phillips, L. Robinson, O. J. Swannie, R. B. A. Wright.

From Student to Graduate:
J. M. Barber, J. F. Everett, S. A. Petch.

LUTON SECTION

As Associate Member:
A. E. Plumley.

As Graduates:
B. D. Bowman, J. C. Mansfield.

As Students:
A. C. Aquilina, B. Blair, P. V. Lloyd, P. L. Semjen.

Transfer—

From Intermediate Associate Member to Associate Member:
D. G. Indge.

MANCHESTER SECTION

As Associate Members:
F. Lazenby, F. McClenan, J. I. O'Brien, N. Robinson, R. Robinson, H. W. G. Wolley.

As Graduate:
K. Thewlis.

As Students:
J. A. Redston, A. R. Rimmer, W. C. Street, K. G. White.

MELBOURNE SECTION

As Associate Member:
N. W. Hodgson.

As Student:
W. G. Sharpe.

New Affiliated Firm:
Haland Engineering (Aus.) Pty., Ltd.

New Affiliate Representatives:
W. K. Leigh, A. E. Atkinson.

Transfer—

From Graduate to Associate Member:
R. P. McMurrich.

NEW ZEALAND SECTION

As Associate Member:
L. J. Leask.

NORTHERN IRELAND SECTION

As Associate Member:
J. M. Dehoney.
Transfers—
From Graduate to Associate Member:
E. A. Conway, K. Teale.

NOTTINGHAM SECTION

As Student:
K. B. Davis.
Transfers:—
From Graduate to Associate Member:
R. G. Reid, L. Rowbotham.

PRESTON SECTION

As Associate Member:
J. Hill.
As Graduate:
D. Duerden.
As Students:
A. Hackett, W. P. Ivison, B. Lee, F. W. Nicholls, J. Shorrock, G. Wilton, I. M. Woods.
Transfers—
From Associate Member to Member:
F. Hodson.
From Intermediate Associate Member to Associate Member:
F. Grey.
From Graduate to Associate Member:
H. J. Mahady.

READING SECTION

As Associate Member:
E. Wilson.
Transfers—
From Associate Member to Member:
E. H. Holder.
From Graduate to Associate Member:
D. Kennedy.

ROCHESTER SUB-SECTION

As Associate Member:
C. W. Farrow.
As Students:
A. C. Dancy, J. Hall, F. W. Tucker, P. G. Varley.
Transfers—
From Graduate to Associate Member:
R. Hedley, J. P. Pearson.

SHEFFIELD SECTION

As Associate Member:
H. T. Woodier.
As Students:
C. E. Sanderson, A. Smith.
Transfers—
From Graduate to Associate Member:
R. Charlesworth, K. Walker.

SHREWSBURY SECTION

As Associate Member:
F. Downes.
As Associate:
L. B. Daley.
Transfer—
From Intermediate Associate Member to Associate Member:
D. S. Druce.

SOUTH AFRICA SECTION

As Associate Members:
C. Archer, G. Marcovic.

As Student:
W. S. Whitecross.

Transfer—
From Graduate to Associate Member:
H. C. Cleaver.

SOUTHERN SECTION

As Member:
C. M. Wilmot.

As Associate Member:
R. Collins.

As Associate:
B. Armstrong.

As Student:
C. J. Norbury.

Transfers—
From Associate Member to Member:
F. A. Hamlin.

From Graduate to Associate Member:
W. T. Hines.

SOUTH ESSEX SUB-SECTION

As Graduate:
R. L. Stearn.

As Students:
P. R. Brister, G. D. Evans, D. Jackson, W. R. Mitchell, P. O'Gorman, O. W. Whitehead.

Transfer—
From Graduate to Associate Member:
G. C. Davey.

SOUTH WALES SECTION

As Member:
A. McDonald.

As Students:
G. K. Greenslade, D. K. Jones, D. G. Williams.

STOKE-ON-TRENT SUB-SECTION

As Student:
F. J. Moore, A. Rawlinson.

Transfer—
From Student to Graduate:
M. Haslehurst.

SYDNEY SECTION

As Associate Members:
A. F. Allen, H. D. Benson, H. Selinger.

WESTERN SECTION

As Associate Members:
R. G. Dansage, D. J. Lewis, G. E. Sevier, F. F. Upsher.

Re-instatement as Associate Member:
J. H. R. Graham.

As Associate:
W. O. Scofield.

As Graduate:
D. M. Anthony.

As Students:
F. S. Darling, M. E. Griffin, K. Hill, D. G. McCarthy, R. Marshall T. G. Mossman.

Transfer—
From Graduate to Associate Member:
W. M. Faulds.

WEST WALES SECTION

As Member:
W. H. Bowman.

As Associate Members:
J. A. Hodge, C. Moorhouse.

As Students:
D. D. Jenkins, D. F. Perry.

Transfer—
From Associate Member to Member:
R. G. Boland.

WOLVERHAMPTON SECTION

As Students:
H. K. Bache, E. M. Lawrence.

Transfers—
From Graduate to Associate Member:
W. Banes, E. Jones.

From Student to Graduate:
J. R. Bradshaw.

YORKSHIRE SECTION

As Graduate:
S. K. Ganguly.

As Students:
G. F. Hudson, J. M. Murray, F. Porter.

Transfers—
From Associate Member to Member:
D. H. Turnbull.

From Graduate to Associate Member:
S. Metcalfe.

From Graduate to Associate:
C. P. Morton.

NO SECTION

Transfers—
From Intermediate Associate Member to Associate Member:
I. Landmann.

From Graduate to Associate Member:
G. El-Kareh.

From Student to Graduate:
R. E. Bullock.

Successful Candidates in 1952 Associate Membership Examination

BIRMINGHAM SECTION

Transfer—
From Student to Graduate:
G. R. Ridgway.

COVENTRY SECTION

As Graduate:
A. R. Manning, L. Wharton.

Transfers—
From Student to Graduate:
J. E. Adkins, D. C. Bear.

DERBY SECTION

Transfer—
From Student to Graduate:
F. C. Davis.

EDINBURGH SECTION

Transfer—
From Student to Graduate:
T. Thompson.

HALIFAX SECTION

As Associate Member:
K. P. Annas.

LEICESTER SECTION

As Associate Member:
A. Groocock.

LINCOLN SECTION

Transfer—
From Student to Graduate:
D. T. Dawson.

LIVERPOOL SECTION

TRANSFER—
FROM STUDENT TO GRADUATE:
A. R. Stoddart.

LONDON SECTION

AS ASSOCIATE MEMBERS:
V. W. Clack, F. E. Langdon, S. A. Pearson.
AS GRADUATES:
N. J. Elander, L. C. Fensom, E. A. Moore, P. K. Overed-Sayer.
TRANSFERS—
FROM STUDENT TO GRADUATE:
J. Crockett, P. J. Galliford, H. R. Harwood, R. H. Hunt.

LUTON SECTION

TRANSFERS—
FROM STUDENT TO GRADUATE:
J. A. Anderson, E. I. Martin, P. D. Mitchell, J. A. Prettyman, R. D. Saha, P. A. L. Signorini, R. L. Tosswill, F. P. Wallace.

MANCHESTER SECTION

AS ASSOCIATE MEMBER:
F. O. Fletcher.

TRANSFER—
FROM STUDENT TO GRADUATE:
G. Pickavance.

PRESTON SECTION

AS GRADUATE:
H. Calderbank.

TRANSFER—
FROM STUDENT TO GRADUATE:
E. Page.

READING SECTION

AS ASSOCIATE MEMBER:
J. Trodden.

AS GRADUATE:
D. G. Murray.

TRANSFER—
FROM STUDENT TO GRADUATE:
D. Pickston.

SHEFFIELD SECTION

AS GRADUATE:
J. H. Shore.
TRANSFER—
FROM GRADUATE TO ASSOCIATE MEMBER:
J. D. Heys.

SOUTH ESSEX SUB-SECTION

AS ASSOCIATE MEMBER:
J. M. Beattie.

SOUTH WALES SECTION

AS GRADUATE:
W. N. Axtell.

NO SECTION

TRANSFER—
FROM STUDENT TO GRADUATE:
K. Todd.

LOCAL SECTION REPORTS

Presented to Council, 24th July, 1952

Adelaide

Meetings held during April, May and June have been well attended and the members of the Committee feel that the programme to date has been very successful.

During the next two or three months the Committee will be working on the programme for next year and it is hoped that the good standard that is evident at the meetings being held during this year will be maintained.

The Section President, Mr. W. Gwinnett, is at present overseas, and during his absence Mr. J. H. Law, Vice-President, is in the Chair. As Mr. Gwinnett will be visiting Headquarters and, it is hoped, some of the Sections in the Midlands, his return is looked forward to with great interest.

Mr. C. J. Clarke, member of the Committee, hopes to be leaving for England and America in the near future and he, too, will take the opportunity when in England of calling at Headquarters.

Birmingham

A feature of Section arrangements in recent years has been special lectures where an international figure has addressed members and visitors. Since the last of the Section lectures in April, two special lectures have been held in the University of Birmingham, through the courtesy of Professor T. U. Matthew and the Department of Engineering Production. In May, Professor O. Schmidt, of the University of Zurich, spoke to a large gathering on " Developments in Factory Layout, and Time Study in Swiss Industry." In June, Professor Otto Kienzle, of the Hanover Technical Institute, addressed members of Birmingham, Coventry, and Wolverhampton Sections on " The Practical Engineering Approach to the Manufacture of Interchangeable Components." Both meetings were most successful. The Committee appreciated the facilities provided by the University of Birmingham, and the efforts of Professor Matthew in securing the support of lecturers so prominent in Swiss and German engineering circles.

Prior to the July Committee Meeting held in the College of Technology, the President and Committee members inspected the Production Engineering and Work Study Laboratories at the College. The Committee were welcomed by the Principal, Mr. J. Wilson, and were impressed with developments at the College.

The lecture programme for 1952-53 is now complete and includes, for the first time, two meetings in Worcester. These meetings have been arranged at the request of members in the area and will, it is hoped, further stimulate local interest.

The 1952 Summer Convention was held on 5th July, when a party of 130 members and wives visited the Bristol Aeroplane Company's works at Filton to see the Brabazon. The success of another Convention was largely due to the generous hospitality and facilities provided by the Directors of the Bristol Aeroplane Company.

Birmingham Graduate

Lectures

The last three lectures have been well attended and favourably received, two of them having been given by Graduates of the Section, Mr. J. W. Smith speaking

on " The Design of Card Box-Making Machinery " and Mr. A. G. Bradbury, Section Chairman, on "Anglo-U.S.A. Productivity Team Reports." This paper has since been awarded the Birmingham Section President's Prize for 1952-53.

The Section is carrying on with the policy of having a theme to cover the whole of the Session in the hope that this will encourage members to attend all meetings. The theme for 1952-53 is " The Status of the Machine Tool in Industry." The total attendance for 1952-52 of approximately 524 for nine lectures suggests that the programme is favoured by members. Ladies are being invited to attend the first lecture of the session, which deals with the history of machine tools.

Visits

The programme of works visits for the coming session is nearing completion. A varied and interesting series has been arranged and, whenever possible, they are complementary to the lectures.

The works visits during 1952-52 were very well attended, the attendance being 209 for six visits.

Bombay

On 10th April the Annual General Meeting was held under the Chairmanship of Mr. R. A. P. Misra, Vice-President. As Mr. C. Warren-Boulton, Section President, was unable to attend the meeting, his Annual Address was read by Mr. Misra. Mr. Warren-Boulton congratulated Mr. Misra on his election as the first Indian Chairman of the Bombay Section, and paid tribute to the splendid work put in by Mr. E. H. Y. Burden during his three years' tenure of office. Mr. Warren-Boulton was quite confident of the continuation of progress of the Section under his Vice-Chairmanship.

Mr. Burden's place as Hon. Secretary/Treasurer will be filled by the present Assistant Hon. Secretary/Treasurer, Mr. P. R. V. Kukde, who becomes the first Indian Secretary.

On leaving India for the United States, Mr. Warren-Boulton, in a farewell message, thanked the Section for the honour done him in electing him as the first President of the Bombay Section.

After the Annual General Meeting, a very interesting and successful discussion on the " Problems Encountered in the Heat Treatment of Metals " took place.

On the 23rd May, Major D. V. Deane, C.I.E., O.B.E., R.E.(Retd.), Master of the Mint, read a most illuminating paper on " The Organisation and Subsidiary Activities of the Indian Mints," one of the most outstanding papers of this quarter. A few days later a very instructive visit to the Indian Government Mint took place.

Applications for membership continue to be received at a satisfactory rate and, considering the short period of the existence of the Bombay Section, its membership has reached a gratifying total.

The Indian Wild-Barfield Award for the best paper read by a member of any grade goes to Mr. A. J. Lund, M.I.Mech.E., M.I.Prod.E., A.M.Ae.S.I., General Manager, Cooper Engineering Ltd., for his paper entitled " Diesel Engine Progress."

The Section was fortunate in being represented again at the Hon. Secretaries Conference at Birmingham; this time by the Hon. Secretary, Mr. E. H. Y. Burden.

Calcutta

Applications continue to be received, and this period quite a number of suitable persons have been recommended for membership.

At the Annual Meeting, minutes were noted and forwarded to London. Several good suggestions were made and it is to be hoped the incoming Chairman and his Committee will see how these can be carried out.

A Committee meeting was held in May at which the new Committee members elected on the 25th April were invited to attend.

No works visit has taken place and this is partly due to the extreme heat in

Calcutta this year and demands on the time of the Section Honorary Secretary.

Nothing further has developed with regard to the Graduate Section, though the Committee are very keen to attract interested Students and Graduates so that a Section can be formed.

The Secretary would like to express his thanks for the co-operation received from the retiring Chairman, Mr. H. Gibson, and also his Committee, and, finally, welcome the new Chairman, Mr. J. D. Mookherjee.

Canada

On 20th February, two senior members of the Committee and the Honorary Secretary had the pleasure of meeting the President of the Institution, General K. C. Appleyard, during his brief visit to Toronto.

Owing to shortage of time it was not possible to hold a meeting with the full Section, nor was it possible to arrange a meeting of the whole Committee. A great deal of business was discussed, including Canadian Section organisation, membership, and collection of subscriptions from members in Canada.

The visit by the President was most beneficial, and the Section was grateful for his interest in their problems.

The Hon. Secretary continues to receive letters requesting information on conditions in Canada from members in all parts of the world who are interested in emigrating to Canada. It would be of great assistance if members would ask specific questions instead of requesting general information. In this way it would be easier for each member to receive answers to his particular problems.

Cornwall

The Annual General Meeting was held on 27th March, prior to the normal monthly Section Meeting. Capt. F. W. Spencer was elected President for the coming year, and the two retiring members of the Committee, Messrs. P. Tromans and H. M. Sawyer, were re-elected.

The retiring President, Mr. F. W. Ross, said that the intensive effort made by the Committee to improve the activities within the Section had already shown gratifying results, and that Cornwall could look forward to a series of well-attended meetings in 1953.

At the following Section Meeting, Dr. T. C. Richards of the Anglo-Iranian Oil Co., lectured on " Geophysical Exploration for Oil " and in April, Mr. W. D. Biggs, of Murex Welding Processes Limited, presented a lecture on " Hard Facing." The Technical Staff of Protolite Limited finished the evening with their excellent sound/colour film, " Hard Metal."

Coventry Graduate

At the Annual General Meeting held in April, three new members were elected to the Committee, which has since been actively engaged in planning the 1952-53 Lecture Programme.

Mr. Wood, a very active member of the Committee, has arranged joint meetings with all the Graduate Sections of other Institutions having centres in Coventry. In this way a clash of dates will be obviated and should result in an improved attendance from Graduates who are also members of other Institutions.

The lecture programme has been planned so that the most important aspects of Production Engineering can be viewed from the batch production and the flow-line production angles, so that a definite comparison can be made. Two lectures have been arranged on Factory Layout, and these are intended as an introduction to this subject which has been selected for definite " case study."

Eastern

The lecture session concluded with a joint meeting in Norwich with the local Sub-Section, when Mr. W. J. Ford read a paper on " Compressed Air and its Practical Applications." This meeting was well attended, and it is felt that it has furthered the interest of Production Engineers in the Norwich area in the work of the Institution.

The lecture programme for 1952-53 is now finalised. This year the Committee decided to depart mainly from the panel of authors circulated by the Institution, and to give preference to local lecturers. With this in mind the Committee have organised a series of lectures representative of the many engineering industries in this area, and it is hoped this will stimulate added interest in Institution affairs.

This year the Committee revived the pre-war custom of works tours during the summer months, and on 25th June a party of members visited the works of the Suffolk Iron Foundry (1920) Ltd., at Stowmarket.

The Committee have appointed Mr. A. B. Brook, Grad.I.Prod.E., as Assistant Hon. Section Secretary.

Glasgow

During the period under review, no meetings have been held but two visits have been made; the first being to Burroughes Adding Machine Ltd., Strathleven, and the second to The Mechanical Engineering Research Laboratory at Thorntonhall.

Members of the Section and their friends were invited to attend an important two-day meeting, arranged by The Institute of Metal Finishing, in Glasgow on 18th and 19th June. The programme included a luncheon, two works visits, a river trip, and two technical meetings.

The Section Committee have met on two occasions during the quarter, and the Lecture Programme for the coming session has been planned and final arrangements are now being made.

Halifax

The March lecture meeting brought to a close general activities for Senior Section members.

The Committee have been actively engaged in arranging the new syllabus, and have decided to revert to the custom of earlier years, in that lectures will be held from October to April inclusive.

Arrangements are going ahead for a joint meeting with Yorkshire and Sheffield, and as this will be the first Regional meeting, it is hoped that success will attend the occasion.

Leicester

The activities of the Section during the period under review have been confined, in the main, to meetings of the Committee. The 1952-53 programme has been prepared and it is hoped that the interesting series of meetings planned, together with a less formal venue, will result in increased attendance.

The death of the first Leicester Section President, Mr. H. Hallam, is recorded with regret.

At the recent visit of Council members to P.E.R.A., the Section was represented by the Section President-Elect and Mr. R. M. Evans, Member of the Research Committee of the Institution.

The receipt of nearly 100 Membership Applications in respect of Loughborough College Students, promises to extend considerably the scope and activities of the Section.

The Committee was privileged to have Mr. W. F. S. Woodford present at a recent meeting.

Lincoln

Section Activities

During the period under review the Section has held its Annual General Meeting and two Works Visits. The Annual General Meeting was held on Wednesday, 26th March, when Mr. E. Burgess, Managing Director, Marshall Sons & Co. Ltd., Gainsborough, was elected President, and Mr. R. S. Hind, Chief Methods Engineer, Ruston & Hornsby Ltd., was elected Vice-President. Mr. Burgess gave high praise to the valuable work done by Mr. J. R. Bergne-Coupland during his two years in office.

An evening visit to Steel Peech & Tozer Ltd., Sheffield, was made on Wednesday, 28th May, and a full day visit to Alfred Herbert Ltd., Coventry, took place on Tuesday, 24th June.

Mr. A. Nicholl, who has accepted a post with the Newall Engineering Co. Ltd., Peterborough, has resigned from the Section Committee. His place has been taken by Mr. E. R. Howlett, Works Director of Aveling Barford (Engineers) Ltd., Grantham, who has been a member of the Institution for nearly thirty years.

General

Mr. H. M. H. Fox has been made a Director of Smith Clayton Forge, Tower Works, Lincoln.

Liverpool Section

The Committee's main activity during this quarter was in connection with the Schofield Scholarship Lecture, which was held at the Adelphi Hotel, Liverpool, on 7th May. The Section was honoured by a visit from Major-General K. C. Appleyard, who chaired the meeting; Mr. W. C. Puckey, Dr. H. Schofield, Mr. H. Burke, Mr. G. R. Pryor, Mr. W. Park, Mr. C. M. Holloway, Mr. W. F. S. Woodford, and other members of Headquarters staff. The subject matter of the lecture and the manner in which it was presented, fully endorsed the Council's selection of Mr. Walton for the Scholarship, and of Dr. Schofield's initiative in instituting the award.

The occasion was also marked by the presentation of the B. A. Williams' Foundation Award for the best Graduate paper in the Liverpool Section. Mr. B. A. Williams was the Founder President of the Liverpool Section, and the first award, which took the form of a medal and certificate, was presented to Mr. R. T. Spencer for his paper on " Research."

The Technical Education Sub-Committee have completed a year of exceptionally good work, and the following issues have been concluded:—

(*a*) Grant of financial assistance by Liverpool Education Committee to members of its teaching staff wishing to attend the Institution's Annual Summer Schools.

(*b*) Recognition of the Associate Membership Examination, by the Burnham Committee of Salary Scales for Teachers, as qualification for the Graduate Allowance.

(*c*) Limited facilities placed at the disposal of members at Engineering Libraries of the Liverpool University.

The Sub-Committee hope to continue their close liaison with the Graduate Committee, especially on issues of Technical Education, and with a view to organising a Section Summer School at Burton Manor. The Sub-Committee were sorry to have to accept the resignation of Mr. Hines, owing to additional demands on his time on being elected Chairman of the Graduate Section.

The death of Mr. H. G. Silverston on 25th June is recorded with regret. Mr. Silverston was one of the Committee's most active members and he will be a great loss to the Section and the Institution.

London

The lecture programme for the Session 1952-53 has been built up carefully to provide a good balance of subjects. At the same time the wishes of members in the Brighton and Croydon areas have been met, as it had proved possible to obtain a fair consensus of opinion in these areas.

Sir Ewart Smith, M.A., M.I.Mech.E., Technical Director of Imperial Chemical Industries Ltd., will open the Session on 2nd October with an address on the work of the Production Engineer in industry, and a paper, " Cost Control and the Production Engineer," will be given by Mr. H. Norcross on 27th November in response to several requests made at the final Brighton meeting.

A paper on modern finishes will be given by Mr. K. W. Abineri, of the Research

Department of Lewis Berger (Gt. Britain) Ltd., on 11th December, and Mr. K. J. B. Wolfe, of the B.S.A. Research Department, is to give a paper on " Recent Developments in Metal Cutting " on 22nd January.

On 12th February, Mr. R. E. Leakey, Section Vice-President, will give a paper on the most important subject of utilising works services, which should be of interest to all who are in any way responsible for the running of a works.

On 26th March, the Annual General Meeting will be held and will be followed by a paper, " Industrial Architecture " by Mr. Howard V. Lobb. The final paper to be held in Central London is the third on " the other man's job." Mr. A. C. Annis, of Metropolitan-Vickers Electrical Co. Ltd., will give a paper on " Building a Steam Turbine."

A meeting will be held in Croydon on 6th November, when Mr. T. Whitwell, F.I.A., F.I.S., F.S.S., F.R.Ae.S., will give a paper on " Figures as a Tool for the Production Engineer," dealing with the ways in which figures relating to all manner of works activities can be collated, and the second Croydon meeting on 12th March will be held jointly with the South London Section of the Institute of Welding.

At Brighton, in the first paper of the Session on 23rd October, Mr. C. H. Starr will deal with overhead expenses and consider the fallacies that can arise in their allocation. The second meeting on 8th January will be devoted to films, the main film being " Pattern for Progress."

To meet the request of members in the Brighton area for a paper on the metrology involved in gear production, on 5th March, Mr. R. Stone of the British Gear Grinding & Manufacturing Co. Ltd., will give a paper on the measurement of gears.

Social activities planned are on a larger scale than last year. A Dinner-Dance will be held on 3rd December at the Savoy Hotel and no efforts are being spared to make this event successful.

In view of the outstanding success of the two stag dinners held since the war, another is to be held on 18th February at Connaught Rooms.

The London Section was well represented at the Section Honorary Secretaries' Conference held at Birmingham in May; Messrs. W. G. Clements (Rochester Sub-Section), R. Hutcheson (London) and R. T. Mustard (Graduate) attended.

Intake of new members into the Section is regarded as satisfactory and the London Graduate Section is to be congratulated on the award of a Schofield Scholarship to Mr. D. C. Howard.

Mr. R. Kirchner has accepted the Presidency of the Section for a second period of one year, and Mr. R. E. Leakey has been elected Vice-President; Mr. M. Seaman has been elected a member of the Committee.

London Graduate

At the Annual General Meeting, two new Committee members were elected, together with two members who had been co-opted to the Committee for the past session, making a total of twelve on the new Section Committee. Mr. R. T. Mustard was elected Section Chairman, and Mr. J. C. Z. Martin, Vice-Chairman. Mr. F. Rutter was appointed Section Hon. Secretary to succeed Mr. Mustard. The Section Committee owes a vote of thanks to Mr. R. B. A. Wright and Mr. J. C. Clarke, the retiring Chairman and Vice-Chairman respectively, and to the retiring members of the Section Committee.

The programme for the coming session will include factory visits, lectures, and an Autumn week-end school. Because of the high standard of past Graduate lectures, considerable effort is being made to include more Graduate lectures in the Section Programme. The Section Committee are also making plans for some kind of Section social activities for 1953.

Luton and Bedford

The programme for the 1952-53 session is well under way. Reviewing the past year's efforts the following figures are of interest:—

Out of a total of 55 applications for membership, 48 were accepted.

Attendance during the Lecture Session, whilst getting away to a bad start through unfavourable weather and lack of members' tickets, improved, and there were over 100 present on two occasions.

Attendance at the Committee meetings each month has been excellent, with an average of 11 out of 15 at each meeting, with two members showing 100 per cent attendance.

Due to travelling difficulties and pressure of business, the Section was not represented at the Annual Conference of Section Hon. Secretaries in Birmingham in May.

Luton Graduate

Activities

On the 28th March, the Annual General Meeting was held in St. Albans, when thirty-five Students and Graduates attended, also four members of the Senior Committee and Mr. Caselton from Headquarters. The competition for the annual Section President's Prize was held after the meeting, when short papers were read by Students and Graduates, the prizewinners being:—

1st Prize: J. B. Wilcox, Graduate—" Machining to Facilitate the Assembly Pump Shafting."

2nd Prize: E. Pennington, Student—" Transmission Gear Inspection."

3rd Prize: H. Layton, Graduate—" Putting a Design into Production."
M. Hemmett, Student—" Statistics in Aircraft Production."

At the first meeting of the newly-elected Committee, changes were made in Committee organisation. Mr. H. J. C. Weighell was again elected Chairman of the Committee; Mr. C. S. Brewer again Hon. Secretary, and Messrs. E. Pennington and M. Hemmett as Assistant Secretaries for Luton and St. Albans areas respectively. Messrs. Signorini, Pennington and Hemmett will comprise the Programme Sub-Committee.

An all day visit to the Royal Aeronautical College at Cranfield took place on Saturday, 12th July.

Membership Growth

Total membership is now 126, an increase of 12 over last quarter.

Manchester

Local Activities

On 21st April, Dr. D. F. Galloway gave his paper " Research in Relation to Production Engineering." The lecture was well received and a good discussion followed.

Committee Activities

The Manchester Committee welcomed the Section President, Mr. R. H. S. Turner, for a further term of office and extended a welcome to Mr. S. Davey and Mr. D. Sheret who were elected to the 1952-53 Committee, the latter having done good work in the co-opted capacity of Assistant Hon. Secretary during 1951-52.

The Committee regretted the retirement of Mr. A. Fraser from the Committee, due to pressure of other work. Mr. Fraser has been a keen member of the Manchester Committee for 21 years.

Further visits have been made in connection with the Machine Tool Advisory Panel, by Messrs. Cranmer and Spencer-Smith of the Manchester Committee.

The Syllabus Sub-Committee, under the Chairmanship of Mr. H. G. Gregory, is well advanced with what would appear to be an original, interesting and instructive series of lectures for the 1952-53 Session. At the May Committee meeting it was recorded that firm arrangements have been made for four of the evenings.

The Section Committee are very pleased to hear that the Finance and General Purposes Committee have approved the issue of a year book. It would be most helpful to Section Officers if this contained business addresses where known, as well as private addresses.

Membership Growth

Applications for membership are continuing at a normal rate. Considering that this Section is one of the largest, it is pleasing to note that the membership has not reached saturation point.

Social Activities

A golf match is being arranged to take place between members of the Preston and Manchester Sections in August.

Manchester Graduate

The lecture Programme for 1952-52 ended with a very interesting lecture on " Photography in Engineering " by Mr. A. Horder.

A party of thirty members and friends took part in a very successful visit to the works of Messrs. Rolls-Royce and the British Railways Repair Depot at Crewe at the end of April.

The lecture programme for 1952-53 Session is now almost complete. An attempt has been made to arrange lectures on a variety of subjects to interest all members. Following the example of other Sections, the Committee hope to devote an evening in November to a " Production Panel."

Melbourne

As mentioned in the last report, meetings are now being held in the Radio Theatre, Melbourne Technical College. The much improved comfort and amenities appear to be appreciated by improved attendance. In April, Mr. J. L. Ross, of the Department of Labour and National Service, spoke on that most important subject of " Training within Industry." This subject gave those present much food for thought.

The 14th May brought a large gathering of 135 to hear a paper on " The Design and Manufacture of Hobs " by Mr. H. G. Sutton, of Sutton Tool & Gauge Co. Mr. Sutton is Vice-President of the Section.

On 11th June, Mr. J. R. Fiddyment, A.M.Brit.P.E., of the Department of Defence Production, presented a paper on "Application of Electronics to Industry." Mr. Fiddyment's paper was supported by an excellent film of the same title, produced by B.T.H. Company, of Rugby.

In an endeavour to spread the Section's activities in other parts of Victoria, an interesting works visit was organised to the Ordnance Factory, Bendigo, in March.

A works visit to Ford Motor Co., at Melbourne, was arranged for 26th June, followed by a lecture in the evening.

North Eastern

Activities for 1951-52 were brought to a close in April with an interesting visit to the works of Victor Products (Wallsend) Ltd., Wallsend-on-Tyne.

Attendances at meetings have been reasonably high and consistent, and discussions have been noted for their well-thought-out contributions.

The lecture programme for the coming Session is practically complete and should offer variety and interest.

Much ground work is being done to introduce competent engineers to the Institution, with the object of increasing membership.

The Section is looking forward with interest to the activities of the coming Session.

Norwich

The Sub-Section has held two meetings during the quarter. On 4th April, a joint meeting with Eastern Counties Section was held in Norwich, when Mr.

W. Ford, A.M.I.Prod.E., gave a lecture on " Compressed Air Techniques." The lecture on " Industrial Heat Treatment Advances," given by Mr. J. McHenry on 7th May, concluded the activities for the first session of the Sub-Section.

The Committee and members wish to place on record their very genuine appreciation of the aid that has been so unstintingly bestowed by the Headquarters Staff and by the Section Chairman and Committee of the " parent " Section at Ipswich in the past eight months of the Sub-Section's existence.

The meetings have been well attended by the members who have brought each meeting to a conclusion with keen discussion, and the guests have commented favourably upon the tenor of the papers presented.

There are now twenty-eight members in the Sub-Section and the Committee have some justified hopes that this figure will continue to be exceeded by at least 25 per cent. for attendance at the four meetings planned for next year. Members visiting the area are most cordially invited to the pre-meeting receptions in the 30 minutes preceding the lectures.

Council Members will doubtless be aware of the continued good fortune of the Sub-Section in the election as Chairman of Mr. K. S. Jewson, M.I.Mech.E., M.I.Prod.E. The Committee anticipate that guidance on policy, etc., will be retained in the sound, precise form it has been consistently given during the past inaugural year's work by the retiring Chairman, Mr. C. H. Frewer.

The Section Secretary would like to convey, through the Chairman, his personal appreciation of the two visits that the Institution Secretary has made to this area during the session; both have resulted in smoothing the path of this " infant " of the Institution's Sections.

Preston

Graduate Activities

Efforts are being made to form a Graduate Section in response to the demand of the Graduates who attended the Birmingham Conference. As a trial of strength, a morning visit to Mullard Blackburn Works was arranged, and in spite of the poor weather, about twenty-five Graduates attended and had an extremely interesting morning. The formation of the Graduate Section will now be discussed by the Section Committee.

Social Activities

The social side of the Section activities has been receiving special attention by the Committee and, as a result, the annual Golf Match between the Manchester and Preston Sections has been revived and will be played in Manchester.

A Section outing, ladies included, is planned to take place during the Autumn.

Winter Programme

This has been varied from previous years and includes the presentation of first-class papers, less formal lecture meetings and an evening devoted to technical films. The meetings will again alternate between Blackburn and Preston.

Reading

Oxford Sub-Section

The formation of an Oxford Sub-Section is definitely being proceeded with for the next Session, 1952-53, with Mr. L. P. Coombes as Chairman. The date for a General Meeting in Oxford and the election of Officers will be given later.

Lecture Programme—1952-53 *Session*

The programme has almost been completed, giving an interesting and varied range of lectures. The number of lectures will total seven, one of which will be held at Basingstoke.

Works Visit

A visit was arranged to Vauxhall Motors, Luton, on 26th June.

Membership Growth

Membership is still growing and a number of recommended applications are awaiting confirmation.

Sheffield

The election of Mr. G. R. Pryor to the office of Vice-Chairman of Council was very warmly approved by the Sheffield Section Committee, who have every reason to know how enthusiastic he has been in the interests of the Institution for many years, and have no doubt that he will fill this position efficiently.

The question of applying Regional control has been thoroughly discussed at all Committee meetings during the year and further developments are awaited. The first Regional meeting has been arranged by the Halifax Section, and the Sheffield Committee will give as much support as possible to this venture.

The lecture programme for next session is completed and includes two joint meetings with kindred societies in the area.

Sheffield Graduate

Since the inception of the Sheffield Graduate Section in February of this year, great strides have and are being made to create an enthusiastic body of young engineers interested in the Institution's work.

A Committee of seven members has been elected, including one Student who will act as Student Representative. All Committee members have some particular sphere of activity, and will report on these activities in a Quarterly News Sheet which will be circulated in the near future to all Sheffield Graduate Section members.

As the Section was only formed early in the year, the Lecture Programme that has just ended was of necessity rather hurriedly arranged. Nevertheless, a high standard of lectures and attendances has been possible.

The Session started with an Informal Discussion on members' production problems. This invoked a great many interesting and complex questions.

The lectures, "Time and Motion Study" by Mr. J. R. Widdowson, and "Screwing Techniques" by Mr. W. Hamer, were excellent and well attended. Two combined lectures and works visits were held in May and June; the May meeting at the English Steel Corporation, when the lecture on "Oil Injection Method of Uniting and Separating Pressure Joints" was given by Mr. J. A. Abrahams. Actual examples were shown after the lecture. The June meeting was held at the works of Samuel Fox Ltd., Stocksbridge, when a lecture on "Degreasing and Descaling Methods" was given by Mr. Moore and Mr. Gutteridge. This was followed by an extremely interesting tour of the departments discussed in the lecture.

South Africa

The following papers were given during the period under review. On 3rd April, Mr. J. F. Attwell, of Metallisation (S.A.) Pty. Ltd., gave a paper entitled "Metallisation," and on 1st May, Mr. G. Yates, of African Cables Ltd., read an illustrated paper on "Cable Manufacture." Mr. G. A. Spence, of Stewarts & Lloyds of South Africa Ltd., gave a paper on 5th June entitled "Tube Making"; this paper was supplemented by illustrations and a film. The Engineers Association was also invited.

During the last quarter, four resignations were accepted and six members were recommended for election. Mr. J. Evans has joined the Section from the U.K., and there has been one transfer to a higher grade.

The question of membership cards was discussed and Head Office has been asked for a ruling.

All members in arrears with their subscriptions were sent reminders, and the result was most gratifying.

The Committee considered the question of badges for members in good financial standing, and the matter was referred to Head Office for approval. The cost of the badge would be borne by the members.

Southern

The Graduate and Student members of the Section have now completed their programme with a visit by charter plane to Rubery Owen & Co. Ltd., of Darlaston, Staffs. Members were welcomed by Mr. A. Owen and Mr. E. Owen, Joint Managing Directors. The members wish to record their appreciation to the affiliated firm of Folland Aircraft Ltd., who have made this series of visits possible.

The Section arranged a Works Visit on 8th July to the Esso Petroleum Company Limited at Fawley, on Southampton Water.

The second visit this year will be to look over the Capetown Castle at Southampton Docks, and this will take place on Wednesday, August 27th.

The Committee have been taking a special interest in educational affairs and have recently accepted an invitation from Mr. F. T. West, the Principal of Southampton Technical College, to look over the College and discuss Production Engineering matters.

South-Essex

Meetings

The last four meetings of the 1951-52 session were well attended, particularly those in Chelmsford.

Works Visits

The possibility of arranging Works Visits during the summer months was explored but the matter has now been deferred.

Committee

Mr. Bailey's term of office as Chairman expired this year and Mr. R. Kenderdine has taken over the Chairmanship for next year.

1952-53 Lecture Programme

The programme of papers has now been completed and it is again proposed to hold the Opening Meeting at the South-East Essex Technical College in September and to alternate the remainder of the meetings between Chelmsford and Ilford. In this matter, once more valuable assistance has been received from the Education Authorities in Chelmsford and the South-East Essex Technical College, where rooms have been placed at the Section's disposal free of charge.

Stoke-on-Trent

Each of the monthly Committee Meetings has been well attended. The news of Mr. Dalley's resignation from the Committee, due to a new appointment which necessitated him leaving the district, was received with very great regret. Mr. Dalley had served for some time as Vice-Chairman and his services and advice had been greatly appreciated. Much time was spent in the approach for fostering a greater link between the Institution of Production Engineers and the Pottery Industry, and it is well to report that after the initial contact with the Hon. Josiah Wedgwood, the opening meeting of the 1952-53 Sub-Section Session will be a paper by the Engineer of the Wedgwood Co., Mr. J. Robinson, B.Sc., A.M.I.Mech.E., A.C.G.I. It is hoped to arrange for a party visit to the Wedgwood Co., prior to the lecture.

Although there are not yet sufficient Graduate members to warrant the formation of a Section, it is pleasing to report that the Manchester Section made it possible for one of the local Graduate members, Mr. R. P. Shaw, to attend the second Graduate Conference in Birmingham on the 29th March, 1952.

It was unanimously agreed to co-opt Mr. J. Tindal, M.I.Prod.E., to serve on the Committee during the next year.

The Chairman, Mr. H. Porter, agreed to accept the invitation of the Birmingham Section President to attend a meeting in order to discuss the Report of the Special Committee on Organisation, and to express the general feeling of the Sub-Section in the matter.

Sydney

Local Activities

At the April meeting, Mr. K. Rickard of the Small Arms Factory, Lithgow, spoke on " Reclamation of Cutting Tools," and now that more stringent economies are being enforced in many plants, this paper proved most interesting.

Mr. G. L. Brunskill presented a paper entitled " Job Evaluation " at the meeting in May. Much work has been done in this field at Mr. Brunskill's firm of C.S.R. Chemicals Ltd., and this, plus the data he submitted of similar work which has been carried out in the U.S.A., showed members that there is yet another avenue open to Management in assessing the valuation of work.

At the meeting held early this month, Mr. W. J. Caples, Lecturer-in-Charge, Department of Management, Sydney Technical College, presented a very lively paper on the subject of " Training for Management at Home and Abroad."

Research—Working Groups

Replies are steadily coming in from a number of firms who were circulated with drawings of an oil pump of an internal combustion engine, asking them to detail these drawings as they would in their normal drawing office practice. The analysis of these replies is now being tabulated and it is hoped that the Working Group will be able to form some opinions as to how much these firms are using basic standards.

Western

As is the practice in most Sections, the Western Section have practically ceased activities for the Summer Session, as far as lectures and regular meetings are concerned.

Members of the Committee were included in a Reception Committee at the Bristol Aeroplane Company, when a large number of the Birmingham Section paid a visit to the works on 5th July.

One problem which still gives the Section cause for concern is that of the members in the Gloucester/Cheltenham area, where it is thought a very active Sub-Section could be formed, if it was possible to spend sufficient time in that district. In this respect, any assistance which Head Office could give would be appreciated, as, apart from one member of the Committee, all the remainder live in or around Bristol; therefore work in the Gloucester area is exceedingly difficult.

Western Graduate

At the lecture meeting held in March, four short papers were read by junior members and the first prize was awarded to Mr. B. R. Cutler for his paper on " Impact Extrusion," while Mr. Butler took second prize with his paper on " Induction Hardening." These papers were judged by a panel of members from the Senior Section Committee.

While this is generally the close season as regards lectures, the Committee have nevertheless been active in arranging the lecture programme for the forthcoming year. Mr. Mawhood and Mr. Sullivan, Graduates in the Gloucester area, have been co-opted on to the Committee and this has resulted in the proposal that a meeting should be held in Cheltenham in November, and one in Gloucester sometime in February. These two meetings will be in addition to the normal monthly lecture meetings held in Bristol. It has also been decided that a register should be kept of all members attending lecture meetings.

All new junior members are now invited to a Committee meeting and so far this has resulted in some useful suggestions being put forward, as well as enabling the new members to meet Committee members prior to attending a lecture meeting.

It has been suggested that in view of the fact that members of the Section are rather widely spread and the Section is comparatively young, a monthly newsletter should be published, giving news of interest to Section members as well as giving a resume of forthcoming events.

Wolverhampton

At the last lecture meeting of the 1951-52 Session, the Section had the opportunity of welcoming Mr. R. K. Allan, Member of Council, who gave his Paper, "Roller Bearings in Service." The meeting was very well attended.

Following the election of Shrewsbury to full Section status, their retiring President, Mr. P. G. Garside, had been elected to Council. Mr. C. L. Old, M.Sc.(Tech.), B.Sc.(Eng.), A.C.G.I., M.Inst.C.E., M.I.Mech.E., M.I.Prod.E., Principal of the Wolverhampton and Staffordshire Technical College, has been unanimously elected Vice-President of the Wolverhampton Section.

The Graduate Section has submitted the name of Mr. J. D. Gutteridge, Grad.I.Prod.E., for the Section President's Prize, this being the first such application.

It is hoped that many members from the Section will support the Summer School to be held in the Midlands this year. The Section is looking forward to co-operation with other Midland Sections in deliberations on the Special Report on Organisation.

Arrangements are well in hand for the Winter Lecture Programme and this will be submitted to the August Committee Meeting for final approval.

Representatives on Council for the coming year will be Mr. R. Beasley, President, Mr. C. L. Old, Vice-President, and Mr. H. Tomlinson, Retiring President. It is felt that by this procedure the experience of the retiring President will be of benefit to the newly-elected officers.

Wolverhampton Graduate

Two lectures have been given by Graduates in the past quarter. One on "Fundamental Machining Problems Associated with the Production of Gas Turbine Components" was given by Mr. P. Spear, B.Eng., of Birmingham Graduate Section, and the other on "Principles of Drop Press and Upset Forgings" was given by Mr. J. D. Gutteridge of Wolverhampton Graduate Section. Both these papers were of a high standard and were illustrated by slides. A good audience of Students and Graduates was present at both meetings. The third meeting was a "Brains Trust" session on "Production Engineering Problems." The panel consisted of four members of the Senior Committee and they answered a wide variety of production questions put to them by the Graduates and Students present.

Four visits have also taken place in this quarter. A very interesting tour was made of the West Midlands Gas Board, Walsall Division, gas producing plant and new extension. On two Saturday mornings, parties of Graduates and Students toured the offices and printing departments of the *Birmingham Post and Mail*. These visits were a great success. Lastly, a party of thirty Graduates and Students travelled by coach to the works of The Ford Motor Co., Dagenham. A tour of the production departments was carried out and proved to be most interesting.

The Graduates held their Dance on Friday, 2nd May, at the Star and Garter Hotel, Wolverhampton. Over 100 Graduates and their friends attended; as usual it was a great success.

Yorkshire

The Syllabus for 1952-53 is well in hand, and during the summer months the chief problem is the two Golf Matches to be played during July.

On Wednesday, 18th June, the President, Mr. F. T. Nurrish, invited all the members of the Committee to dinner, when he expressed his thanks for the support he had received during his two years as President.

In reply, Mr. J. E. Hill presented to Mr. Nurrish a Silver Salver from the members of the Committee in appreciation of his work for the Institution, and the Yorkshire Section in particular, during his term of office as Section President.

Yorkshire Graduate

During the period under review, the Section Chairman has sent a questionnaire to all members requesting suggestions for the future programmes. The replies have proved most helpful in arranging the programme for the coming session.

The Past President of the Senior Section has offered a prize to the Graduate who gives the best paper during the coming session.

The Section Committee have stated that the *Journal* has not shown much improvement during the past year and have suggested that it should re-introduce the Technical Bulletin which ceased to be included a few years ago. Another suggestion was that when notification of a lecture is circulated, a synopsis of the lecture should be included.

INSTITUTION AWARDS

Lord Austin Prize

This prize consisting of books and/or instruments together with a certificate, is presented annually for the best Essay submitted by a Graduate of the Institution. Details of conditions are published in the Journal each year

Hutchinson Memorial Medal

A medal is awarded annually for the best paper presented to a Section by a Graduate of the Institution.

Institution Medals

Silver medals are awarded each year for the best paper presented to a Section during the year by (a) a member, and (b) a non-member.

Schofield Travel Scholarships

The Scholarships provide for two Graduates each year to spend six months on industrial study visits in selected overseas countries. Details and conditions of the Award are published each year in the Institution's Journal.

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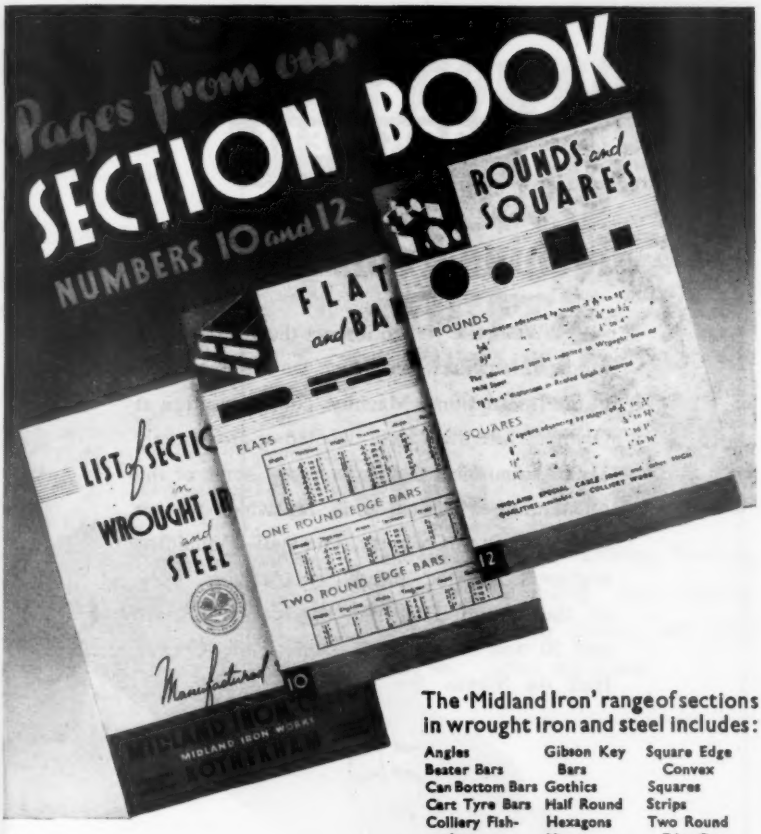

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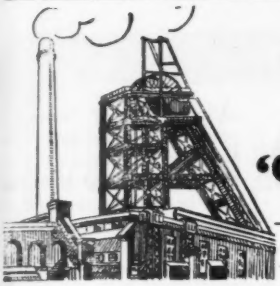

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